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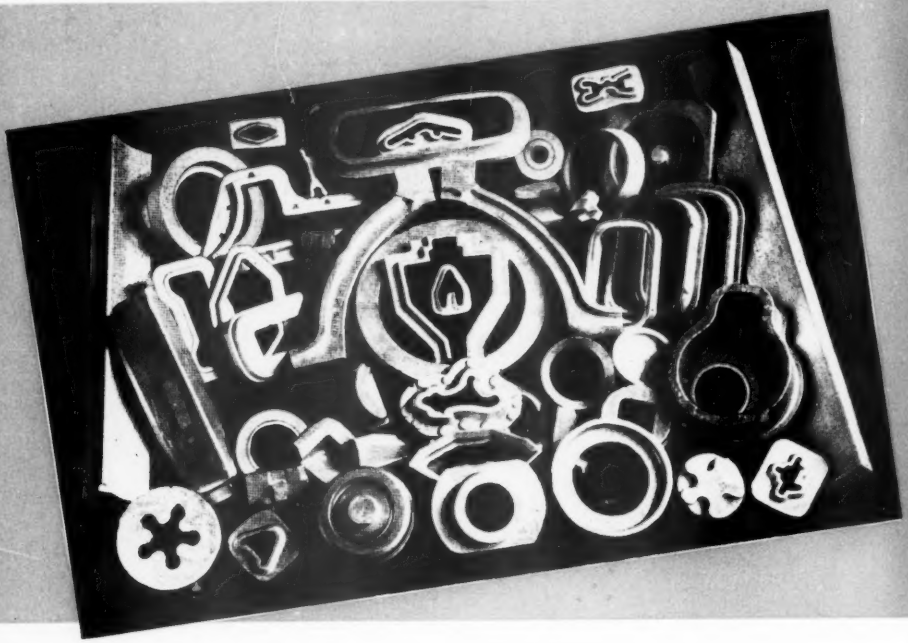

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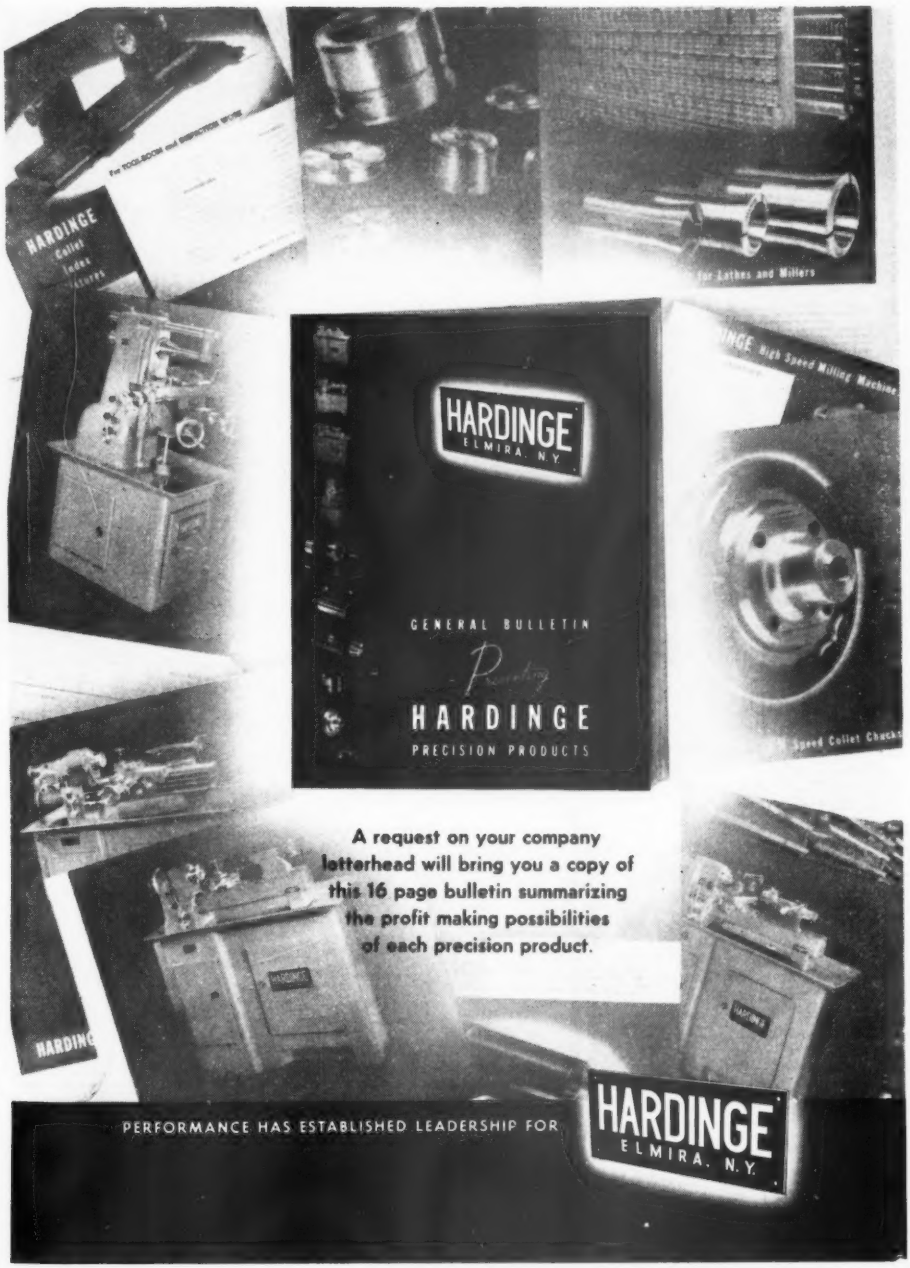
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THE TOOL & DIE JOURNAL

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◆

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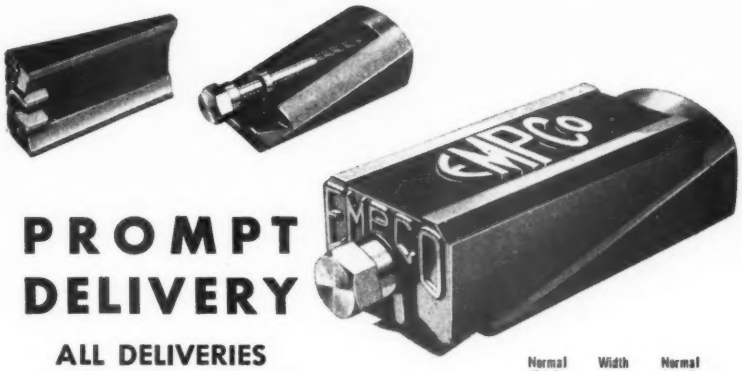
Not only SET Your Machines *LEVEL*, but they KEEP 'EM *LEVEL!*



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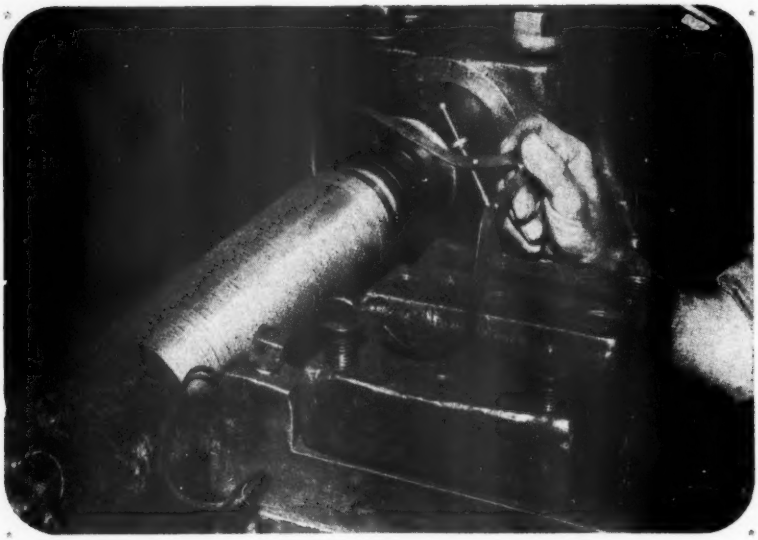

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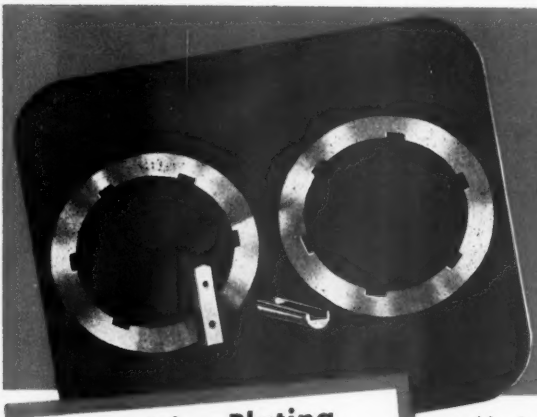

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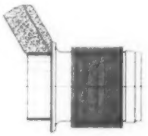

• With the wheel at an angle, an equally fine finish is produced both on the diameter and adjacent face of the flange.

The illustrations at the left show how a precision grinding job was handled with this thought in mind by CINCINNATI Engineers. The part, an aircraft cylinder barrel, requires accurately ground surfaces on the diameter and adjacent face of the flange. To do these operations in the most rapid and accurate manner, both are finished in one setting of the work. This requires the grinding wheel head unit to be set at a 30° angle, so that the wheel would make a line contact with the flange (same as the diameter) and thereby produce the best possible finish. The headstock and footstock were interchanged for the purpose of directing the thrust of the cut against the headstock unit. In addition, the machine is equipped with a standard automatic infeed attachment giving the operator a chance to complete his non-productive chores during the grinding cycle. This set-up assures exceptionally close accuracy and rapid production.

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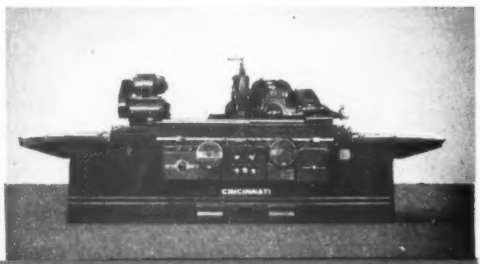

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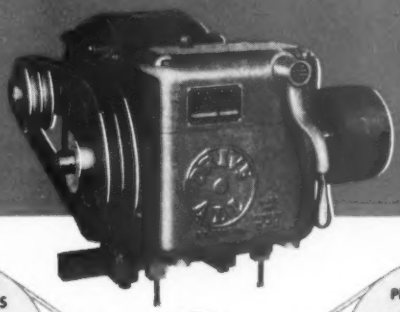

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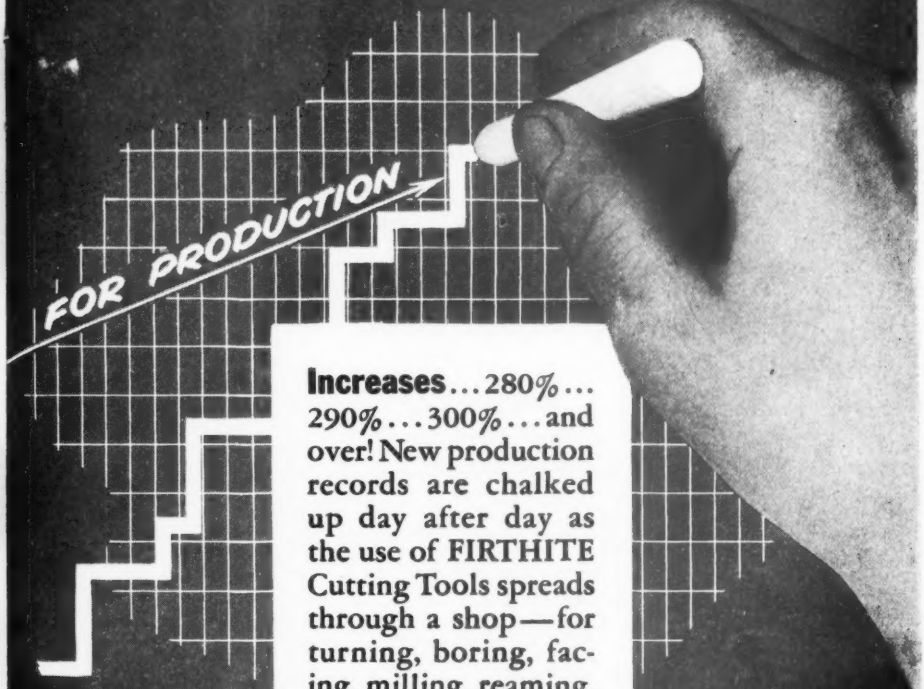

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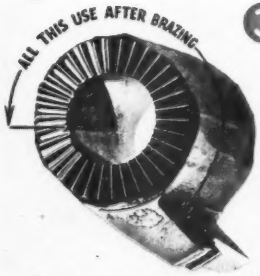

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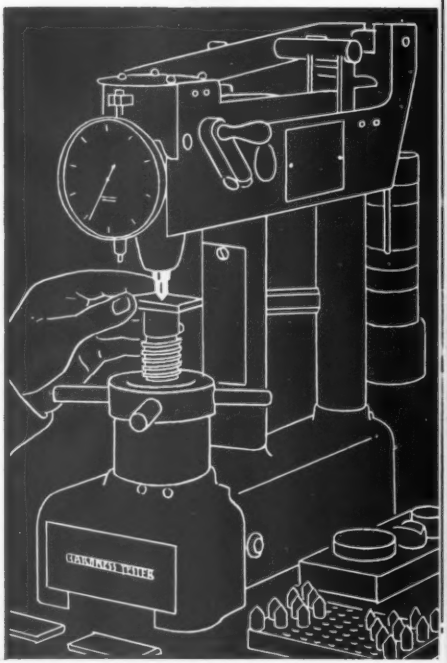

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LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

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- ☐ AUTOMATIC LATHES
- ☐ HEAVY DUTY GEARED HEAD GAP LATHES
- ☐ SUPER REGAL GEARED HEAD LATHES
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- ☐ AUTOMATIC CRANKSHAFT LATHES
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YOUR NAME _____ TITLE _____

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Your Bonds Buy Bombs
Buy a "Blood-Buster" Today

As Safe as at Home...

"Yes Bob . . . with **LIMA GEARSHIFT DRIVES** on our machines, we are as safe as if we were in our own home".

With thousands of new hands on America's production lines today, it is vitally important that your machines and tools be equipped with the most dependable method of motivation. With **LIMA'S** driving your machines, you are certain of flexibility in your plant and production layout and sure that your operators have the utmost in Performance, Safety and Ease of Operation.

For Fast, Safe, Dependable production, specify Lima Gearshift Drives, Pedestal Grinders, Magnetic Polishing Lathes and Electric Motors. Wire or write for address of Lima Engineering Service nearest you.

Large enough to successfully serve you, yet small enough to give personal attention to your needs.

THE LIMA ELECTRIC MOTOR CO.

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REPRESENTATION IN MOST PRINCIPAL CITIES

LIMA GEARSHIFT DRIVES - LIMA ELECTRIC MOTORS
LIMA MAGNETIC POLISHING LATHES - LIMA PEDESTAL GRINDERS

he's calling his shots

ARE YOU?

● HE is our Army, Navy and Marines. The job they are doing is bringing us closer to a "peace-work" job, faster than we had dared hope for. Peace, when it comes, lasts for only a few minutes of whistle-blowing and bell-ringing. This is the signal for American business to take the ball and score—or (pray, no) fumble and stumble in a muddle of our own making. HIS clear sights are pointed to the green lights of all-out peace-time production and prosperity. American bombardiers are "on target". Are you? Call your shots, Mister Businessman. Call on LeBlond NOW for improved turning equipment.

THE R.K. LeBLOND MACHINE TOOL CO., CINCINNATI, 8

time to retool
Turn to LeBlond for Turning Equipment
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

Check-Clip-Mail
FOR ILLUSTRATED SPECIFICATIONS:
- ☐ HEAVY DUTY GEARED HEAD ENGINE LATHES
- ☐ TOOL ROOM LATHES
- ☐ AUTOMATIC LATHES
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- ☐ RAPID PRODUCTION LATHES
- ☐ AUTOMATIC CRANKSHAFT LATHES
- ☐ No. 2 CUTTER GRINDER

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Buy a "Eleel-Buster" Today

TO MASS PRODUCE PARTS LIKE THESE...

Turn to Turchan

THE ALL-HYDRAULIC DUPLICATOR

THE *forte* of Turchan Followers is high speed production of parts like those pictured here. Any part of irregular or eccentric shape or contour — any part that normally requires time-killing and painstaking hours on a machine tool *can be produced with a Turchan-equipped machine tool from three to twenty times faster*

Turchan-equipped machine tools do not require highly skilled operators — no matter how intricate the machining job on hand may be. Any fair machine hand can handle one efficiently.

Turchan Followers attach easily to any standard lathe, shaper, grinder, planer or mill. Furthermore, they can be quickly disengaged whenever direct machining is desired. That's why many production men are *Turning to Turchan,* for faster, more efficient output. *Send for our new, free booklet on Turchan Followers today.*

TURN TO *Turchan* FOLLOWER MACHINE CO.

Originators of Hydraulic Duplicating Attachments

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NEW METHOD of MANUFACTURE *ENGINEERS*
LONGER LIFE INTO THESE VITAL TOOLS

Melin-Patented *Micro-Precision* Machining Gives You 3 Advantages

1 BETTER CUTTING EDGE
Double backoff eliminates too sharp cutting edge . . . *retains* strength in mill. Teeth are hollow-ground. Chips curl out without clogging!

2 ASSURED UNIFORMITY
Melin-patented "Lead Master" *assures* uniformity of each flute!

3 GUARANTEED CONCENTRICITY
Melin "Concentri-matic Fixture" eliminates possibility of "run-out" . . . *guarantees* concentricity!

TWO NEW BOOKS YOU SHOULD HAVE

THE STRANGE CASE OF THE MURDERED END MILL
Tells how to correct Overheating, Chatter, Breakage, Slippage, etc.

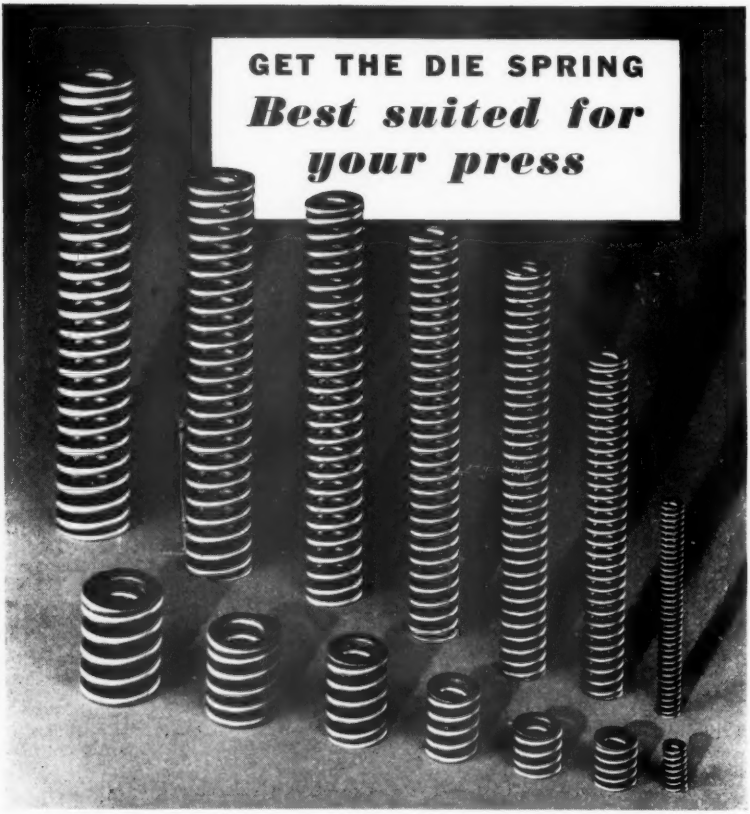
NEW MELIN CATALOG 5-A
Gives complete prices and specifications on Standards. Inquiries on Specials receive prompt attention.

MELIN MILLS

DETROIT 2228 Bellevue Ave. | GRAND RAPIDS 1331 Phillips, S.W.

Melin Mills
2228 Bellevue Ave., Detroit 7, Mich.
Without obligation, please send me
☐ The Strange Case of the Murdered End Mill.
☐ New Catalog No. 5-A and literature on MELIN Long-Life High-Speed END MILLS.

NAME..... TITLE.....
COMPANY.....
CITY..... STATE.....



Designed to meet the rigorous requirements of your presses, Muehlhausen Die Springs of the proper sizes and types can assure you finer, faster die work.

Muehlhausen Die Springs are available in Series "S" for high speed; "M" for regular speed; and "HD" for heavy duty presses. Over 200 sizes are stocked, ranging from 1 to 15 inches in length, and exerting pressures from 80 to 3,000 pounds.

FREE BULLETIN!
New Die Spring Booklet describes 206 sizes and types of die springs.

Muehlhausen Spring Corporation
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Send New Die Spring Booklet, Free.

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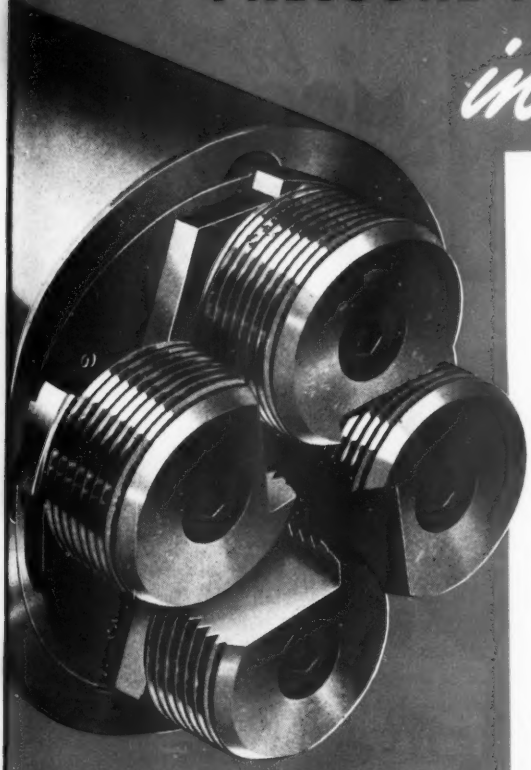
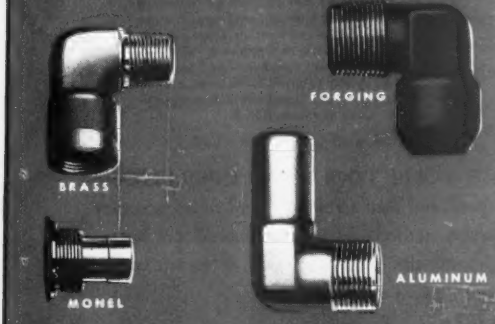
MUEHLHAUSEN SPRINGS
EVERY TYPE AND SIZE

How to turn out Class 3 PRESSURE-TIGHT THREADS *in less time*



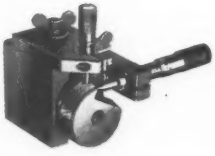


More and more men who have tight schedules to maintain are using Namco Circular Chaser Die Heads. They will tell you that these tools will turn out more work—per hour or per day. Class 3 threads, too, on a production basis.

Chasers are reground on blocks. Inserting a duplicate set in head is a two-minute job, and you are ready to cut identical threads, without "trying for size" and without work spoilage.

In the same rigid head, circular thread chasers may be interchanged with hollow milling cutters and blocks.

Capacities: .056" to 4⅞"—revolving or stationary type. Send for Catalog D-42.



Namco Micrometer Gauge

determines correct amount of metal to remove for Circular Chaser grind, and double-checks precision after grinding.

Namco Circular Chasers

may be ground through 270° of circumference. They last 10 to 30 times longer, with no loss of precision.

THE NATIONAL ACME CO.

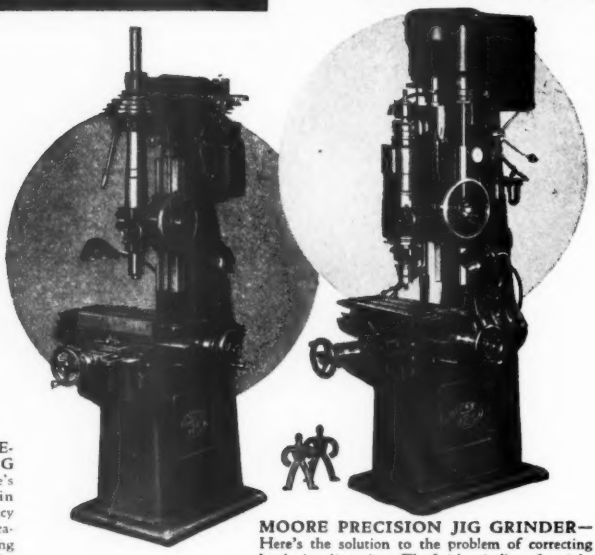
170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • THE CHRONOLOG • LIMIT AND CONTROL STATION SWITCHES • SOLENOIDS • CENTRIFUGES • CONTRACT MANUFACTURING

Ground Bored

by MOORE

"Partners in Production"



MOORE PRECISION JIG BORER—Here's the last word in accuracy, efficiency and ease of operation for the boring of holes in jigs, fixtures, dies, gauges and special, accurate machine parts. The Moore Jig Borer is highly sensitive for holes of 1/32″ diameter or less and yet rugged for heavy cuts up to 4½″. Operators can accurately spot, drill, ream and bore in one uninterrupted sequence with the Moore Jig Borer.

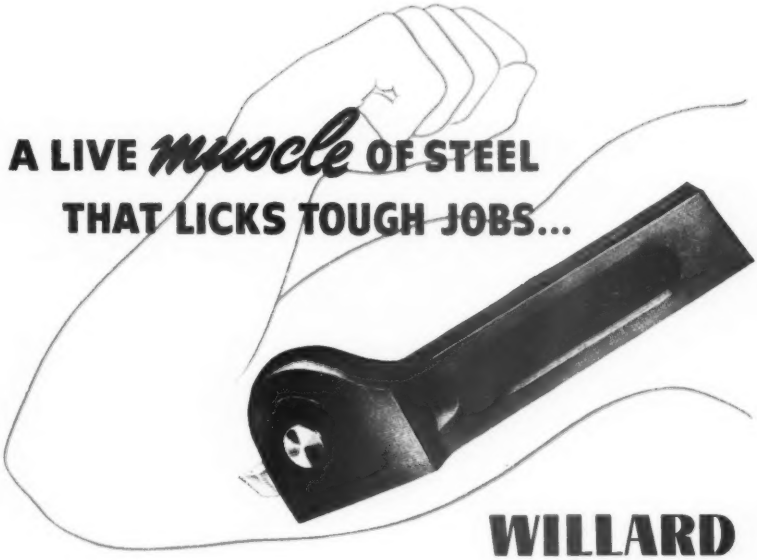
MOORE PRECISION JIG GRINDER—Here's the solution to the problem of correcting hardening distortions. The finish-grinding of straight and tapered holes to size and location is now possible in one-quarter the time formerly required—and with greater accuracy and fewer mistakes. The Moore Jig Grinder has a capacity to grind holes from .030″ to 4″, accuracy of screws of .00005″ per inch and grinding speeds of 15,000 to 45,000 RPM.

MODERNIZE YOUR TOOLROOM OPERATIONS with these companion machine tools. Moore-produced lead screws, ground to an accuracy never achieved before, give the coordinate location method—features of both Moore tools—definite advantages over the graduated scale and size block methods of measurement.

Ask today for full details on the Moore Jig Borer and Jig Grinder.

MOORE SPECIAL TOOL COMPANY INC.
BPT. CT.
740 UNION AVENUE, BRIDGEPORT, CONN.

A LIVE *muscle* OF STEEL THAT LICKS TOUGH JOBS...



WILLARD *Spring* TOOL HOLDER

For Threading and Forming

Right hand offset. Made in 3 sizes for 1/4", 5/16" and 3/8" square bits. Furnished with hardened wrench and one high speed cutter.

Resilient strength, not rigid inflexibility, is the secret of Willard Spring Tool Holders. It's the reason why these Holders are so successful in preventing cutter breakage and damaged work... why they can be used for fine or coarse threading without danger of chatter or tool marks... why they can handle faster feeds with a heavier cut... why they are so adaptable to a wide variety of work... and especially why you should specify Willard Spring Tool Holders for economy, efficiency and accuracy!

Write for descriptive booklet

FORMING TOOL HOLDER

Straight and right hand offset. For cutter 5/8" x 2" diameter. Furnished with hardened wrench and one soft blank cutter.

AUTO-ORDNANCE *Corporation*

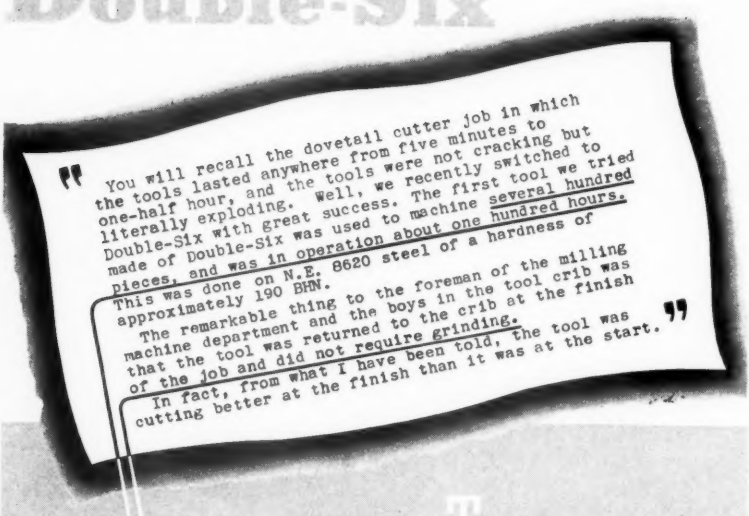
THOMPSON TOOL DIVISION

342 West Putnam Avenue, Greenwich, Conn.

Awarded to Auto-Ordnance Corporation for excellence in production of "Tommy" Guns

GREENWICH • STAMFORD • BRIDGEPORT • NEW YORK

LATROBE
Double-Six


"You will recall the dovetail cutter job in which the tools lasted anywhere from five minutes to one-half hour, and the tools were not cracking but literally exploding. Well, we recently switched to Double-Six with great success. The first tool we tried made of Double-Six was used to machine several hundred pieces, and was in operation about one hundred hours. This was done on N.E. 8620 steel of a hardness of approximately 190 BHN.
The remarkable thing to the foreman of the milling machine department and the boys in the tool crib was that the tool was returned to the crib at the finish of the job and did not require grinding.
In fact, from what I have been told, the tool was cutting better at the finish than it was at the start."

definitely increases tool life... decreases set-up costs...

THE above excerpt is from a letter recently received from an enthusiastic user of Latrobe DOUBLE-SIX. Such performance is typical of Double-Six. Not only will it be found to effect substantial savings in production time, but it will prove superior in many difficult cutting operations. Double-Six can be readily heat-treated to attain maximum efficiency.

Ask for special bulletin on Double-Six.

Ask for a copy of LESCO REFERENCE TABLES containing pocket size pages of useful technical data and tables. FREE

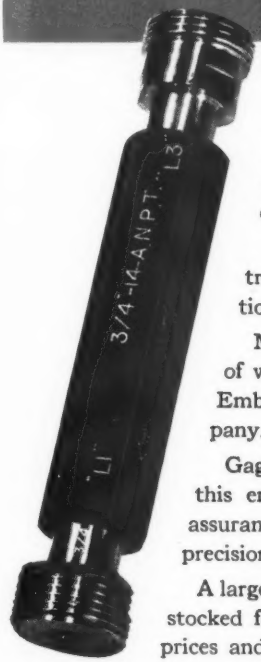
TOOL STEELS LESCO FOR VICTORY

Latrobe ELECTRIC STEEL COMPANY

MAIN OFFICES and PLANT · · LATROBE · PENNSYLVANIA

100,000 GAGES

FOR ONE JOB!



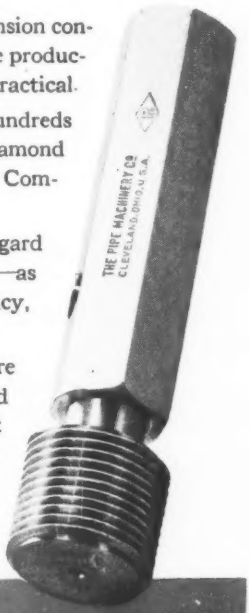
One of the leading builders of airplane engines has that tremendous number of gages in constant use—a fact that portrays vividly the precision requirements of modern manufacturing.

Without this accurate dimension control, our American straight-line production methods would hardly be practical.

Many of the gages used in hundreds of war plants carry the PM Diamond Emblem of The Pipe Machinery Company.

Gage users have learned to regard this emblem—on a gage or tool—as assurance of high standard accuracy, precision and perfect finish.

A large number of standard gages are stocked for immediate shipment. And prices and delivery dates will be sent on request, to cover gages designed to meet special requirements.



PMCO

The PIPE MACHINERY COMPANY Cleveland, O.

GAGES • HOBS • MILLING CUTTERS • SPECIAL TOOLS

33 years of precision workmanship and reliable service ...Sossner's reputation is your guarantee of satisfaction.
SPECIAL TAPS
STANDARD TAPS
High speed, precision ground from solid stock in American National, full or modified Whitworth, and British Association threads.
ALSO: STEEL STAMPS • GAGES • CUTTING TOOLS
SOSSNER
161 Grand Street, New York City 13, or 27 Broadway, Lynbrook, N. Y.

SKILSAW brings production-line speed to crating and car-loading jobs!

Put your shipping rooms on a real production basis with SKILSAW to speed *all* sawing. This powerful, *easy-handling* saw goes to each job and saves material handling. It pre-cuts lumber to uniform lengths and widths for quick assembly into crates. It sizes 2x4's swiftly and accurately *inside the car* for freight-car bracing. SKILSAW speeds uncrating, too . . . protects contents from damage in opening and salvages crating lumber for other uses.

Whatever the sawing jobs in your plant . . . in shipping, receiving, maintenance or production departments . . . SKILSAW will do them faster, better and with fewer men. Ask your distributor for a demonstration of SKILSAW *now!*

SKILSAW, INC., 5061 Elston Ave., Chicago

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SKILSAW PORTABLE ELECTRIC TOOLS

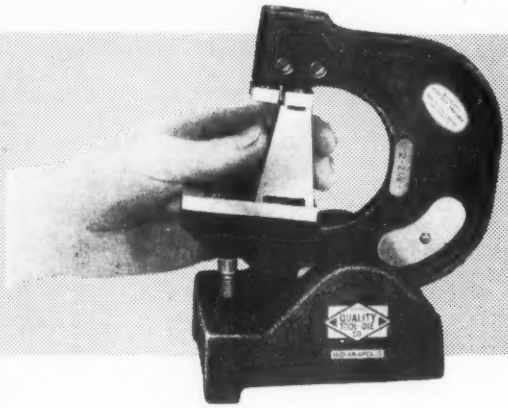
★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

SPEED UP GAGING IN
Your PLANT WITH

Quality

"KWIK-CHEK"

ADJUSTABLE LIMIT SNAP GAGES



HEAVY-DUTY TYPE
Fast . . .
Accurate . . .
Rugged

★ The gaging of odd or irregular-shaped pieces need not be a production "bottleneck." Quality "Kwik-Chek" Adjustable Limit Snap Gages are designed for speed and accuracy. Note the lower anvil extending beyond back edge of top gaging button. This helps in gaging counter-bored work. All Quality "Kwik-Cheks" are equipped with AGD Locking Device. Available in sizes: .0″ to 6¼″ in Heavy-Duty Type and .0″ to .760″ in Midget Type.

WRITE FOR ILLUSTRATED PRICE LIST

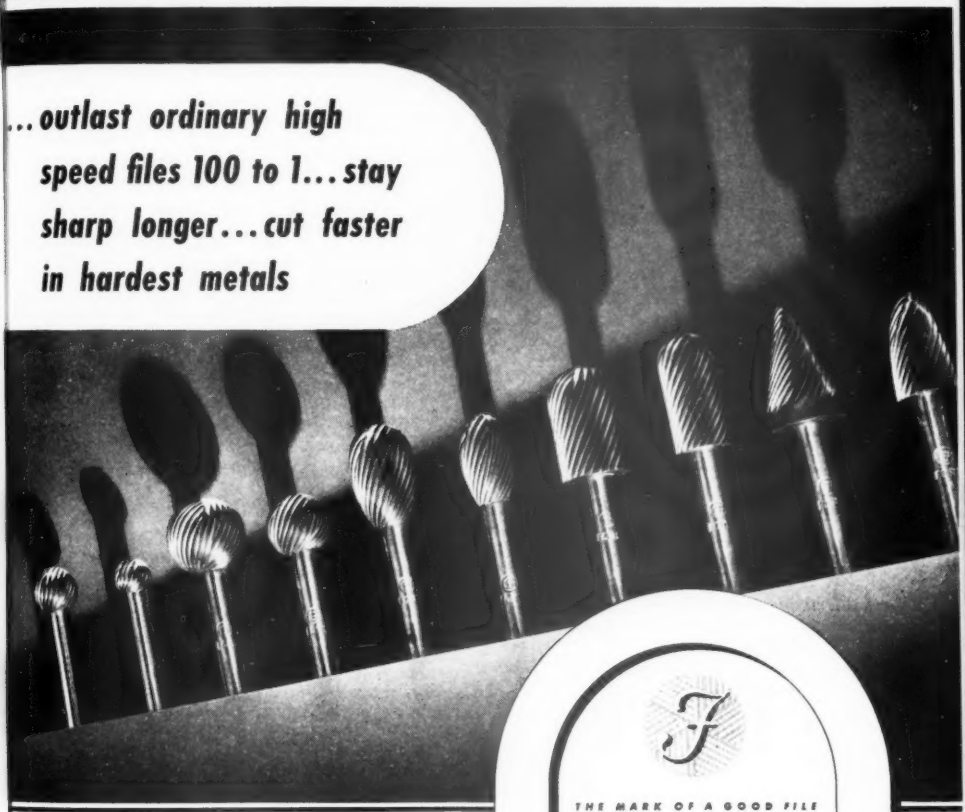
Quality **TOOL & DIE CO.**

N. Noble & E. Vermont, Indianapolis, Indiana

MANUFACTURERS OF "QUALITY PRODUCTS"

NEW CARBIDE CUTTERS

...outlast ordinary high speed files 100 to 1... stay sharp longer... cut faster in hardest metals



NOT for ordinary filing needs, but for jobs and metals that require faster cutting, harder biting rotary files, Ford Carbide Cutters come as the answer to a long existing need. Carbide Cutters give you 100 times longer life, and retain their diamond ground cutting keenness—and thus their original shape and size—vastly longer. A precision, more economical file for high production output, in every respect. Now available in 10 sizes and 5 shapes. Write for special catalog and full details of production advantages. M. A. Ford Manufacturing Company, Inc., 739 W. First St., Davenport, Iowa.

THE MARK OF A GOOD FILE

FORD

Ground from Solid
ROTARY CUTTERS

Hand Cut
ROTARY FILES

"This is a Grinding War . . ."

Copyright 1892 and 1920 by Harper & Bros.

FIGHTING TOP-

A terror in its day was the Gatling gun, shown here in the fighting top of an 1892 battleship. It was good as guns went then, when there was no such thing as production grinding, but modern weapons leave it far behind.

How did our fighting equipment make such progress in so few years.

Give a pat on the back to those who dreamed up the new designs—and to the far-seeing men who spark-plugged research in years of peace as well as war. Much credit, however, for the development of our precision ordnance must go to American mass production methods. But without grinding methods and processes, mass production as we know it could not exist.

Take the modern anti-aircraft gun. Every moving part must be ground to split-hair precision. It is this precision which enables the gun to fire with such deadly accuracy, so rapidly and so continuously.

And this goes for every other piece of fighting equipment, too. Every moving part in the engines which carry a plane, tank, truck, jeep, sub or ship into battle must be ground to closest tolerances.

Grinding is on the job even before production of these weapons begins.

The cutters, reamers, drills and broaches of machine tools that *make* machines of war must also be ground to close limits.

Carborundum has helped to develop many modern grinding processes in the past. And today, because "this is a grinding war," our engineers, research men—*all* of the men and women of Carborundum are working with redoubled energy.

Their contribution to the war effort received official recognition when the men and women of Carborundum were recently awarded the Army-Navy "E" Production Award. And they stand ready to make a similar contribution toward a better world of peace.

Every hour this war is shortened will save $12,000,000. The lives it will save are priceless. So please remember that grinding wheels, too, are "Weapons for Production"... use them wisely to help end the war sooner. The Carborundum Company, Niagara Falls, N. Y.

THE CARBORUNDUM COMPANY

Carborundum and Aloxite are registered trade-marks of and indicate manufacture by The Carborundum Company

More PRODUCTION AT *Less* EXPENSE FROM YOUR AIR TOOLS

● Carefully made of the best materials, from correct designs, CLECO pneumatic tools are built to stand the service on *any* job. However, increased production depends upon a few simple precautions, which often have no bearing directly on the tool itself. Here are a few:

Be sure to use the right grade of oil. In general, a light oil of high quality is what you need.

Avoid abusing the tool by rough handling, permitting parts to become loose; using unsuitable wrenches, or clamping the body of the tool in a vise. Leave repairing to the regular tool repair man.

Use adequate hose and pipe lines, with traps for water and trash.

Oil the tool about once an hour when the service is continuous.

Don't remove screens in connection bushings.

THIS HAMMER SURE HAS GOT A KICK TO IT !!!
120
LOOK AT YOUR AIR PRESSURE — AT 80 TO 100 LBS. THE TOOL WILL GIVE YOU MORE WORK IN THE LONG RUN, AND WILL HOLD BETTER TOO

Use air of the correct pressure, generally 80 to 100 pounds at the tool.

50,000 OF THESE FREE BOOKLETS ARE HELPING SPEED PRODUCTION

Have you sent for your copy?

The cartoons shown here are samples from our tremendously popular Cleco Cartoon Booklet, full of easy-to-remember operating instructions. Send *now* for your free copy.

THE CLEVELAND PNEUMATIC TOOL CO.

Branch Offices in All Principal Cities

3781 East 77th St., CLEVELAND 5, OHIO

Thanks to the

SUNNEN PRECISION HONING MACHINE

GIRLS IN 'TEENS

are handling jobs in "tenths"!

Aluminum Aircraft Link "produces high finish without bell-mouthing."

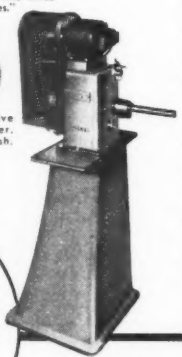
Inner Bearing Ring "Accurately removes last 'tenth' of stock."

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Cones for Wheel Balancing Machine "Accurately align hones two interrupted surfaces."

Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

Aircraft Valve Tappet Roller. 4-Micro finish.



and they can be trained in a few hours.

The guaranteed accuracy (.0001") and super-smooth finish (2 to 3 micro inches) assure fewer rejects and interchangeability of parts.

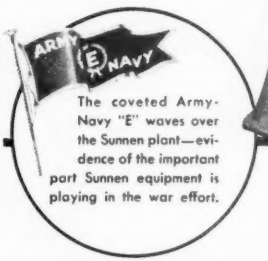
Low in Cost — Economical to Operate

The basic price of the Sunnen Precision Honing Machine is only $195! And it's economical to operate.

No jigs or fixtures — work is held in hands. Relieves big internal grinders for other jobs.

Wide range — handles any internal diameter from .185" to 2.625".

Find out what Sunnen equipment can do for you on your job — one of our engineers will be glad to call and help you solve your problems. Or — if you prefer — write for free bulletin giving complete information.



The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

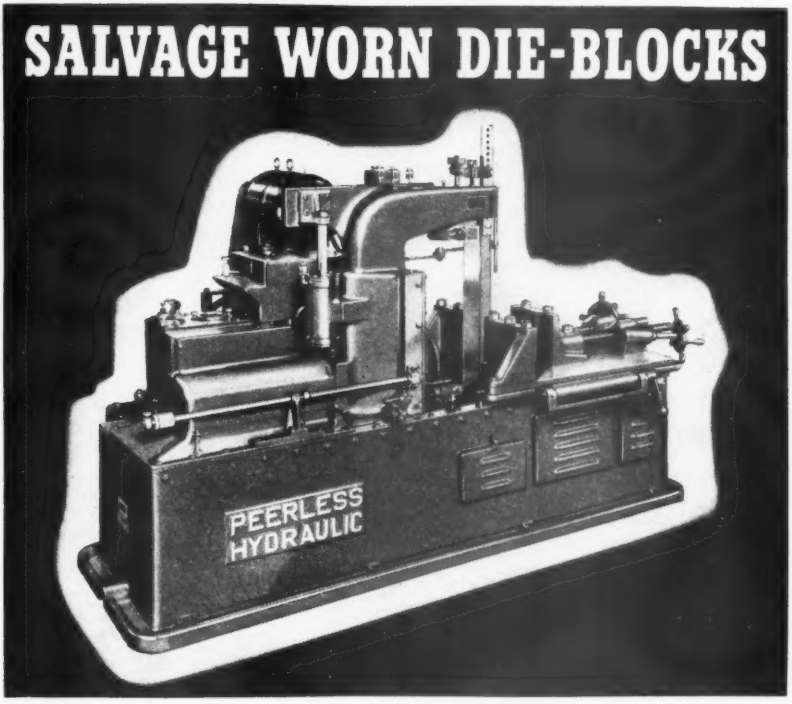
SUNNEN

SUNNEN PRODUCTS CO.

7947 Manchester Ave., St. Louis, Mo.

Canadian Factory: Chatham, Ontario

SALVAGE WORN DIE-BLOCKS



SAVE TIME AND METAL WITH THE PEERLESS VERTICAL

Stock 24 in. long and 10 in. wide can be sawed without turning the work. Extension of the working table to 35 in. permits loading by crane. Peerless, the only Vertical Saw of this type, is the only metal cutting machine with full, automatic, hydraulic control of the feed, blade lift, blade return and elevating rollers. In sawing valuable tool stock, the Peerless Vertical cuts square and true, enabling tool and die makers to use scrap pieces for smaller dies, strippers and stripper plates. Mail the coupon for estimate of cutting time on your toughest operation and full details on how the Peerless Vertical can save time and metals for you.

PEERLESS MACHINE COMPANY
1600 JUNCTION AVE. • RACINE, WIS.

Peerless Mach Co., Dept. TD-943, Racine, Wis.
Mail cutting time estimate for.....
☐ Mail catalog on Hydraulic type Saw for High Production Cutting
☐ Mail catalog covering Vertical type used for Die Block Work
☐ Mail catalog on Mechanical type Saw for production cutting
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Individual.....
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Peerless
THE ONLY METAL CUTTING SAW WITH FOUR-SIDED SAW-FRAME AND BACKING-PLATE

Fast ACCURATE Sawing DEMANDS PEERLESS BLADE CONTROL

INFORMATION, PLEASE

Today, as ever, Cincinnati Shapers are indispensable in both the large plant and the small shop. Such Cincinnati features as: built in power rapid traverse to the table, multiple cam feeds, direct reading indicators, bring to the user of a single machine or of many machines an outstanding usefulness.

Write for informative book N-2 on the complete line of Cincinnati Shapers.

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

PRODUCTION GRINDING *Simplified!*

FLEXIBLE

Attach a Dumore Precision Grinder in any position to any machine tool — for external or internal grinding.

DURABLE

Exclusive design features and precision manufacture give Dumore the stamina for long hours of precision work.

ECONOMICAL

Equivalent investment will supply more grinding facilities in Dumore Precision Grinders than in any other way.

● When Scully-Jones & Company were called on for greatly increased production of precision cutters, reamers, drills and similar tools needed by their customers for war production, they faced a serious shortage of cylindrical grinding machines. The difficulty was solved by mounting some 24 Dumore Precision Grinders on various available bases, with only a small amount of rebuilding. Thus, at negligible cost, they provided a formidable battery of precision grinders sorely needed to augment their production facilities. Ingenuity triumphed and the resulting production of their grinding department is convincing evidence of the practical efficiency of Dumore Grinders.

Explore the full possibilities of the "Dumore System" in stepping up the precision—and the volume—of your products! Ask your distributor for full details—or write for complete catalog today!

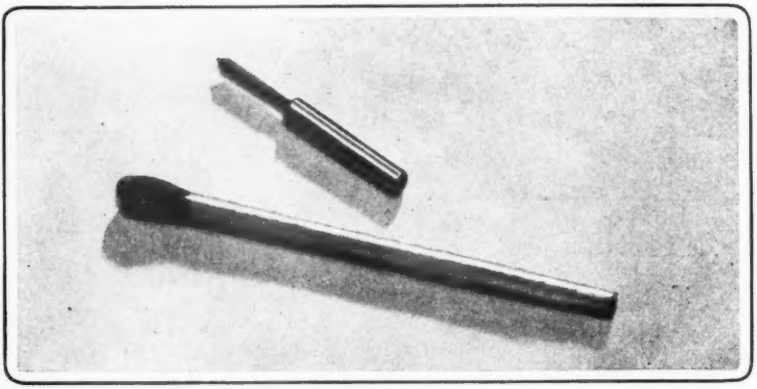
The Dumore Company, Grinder Division, Racine, Wisconsin

Dumore PRECISION GRINDERS

The Heart of the Grinder is the Quill!

DUMORE PRECISION GRINDERS ARE SOLD BY AUTHORIZED DISTRIBUTORS IN ALL PRINCIPAL CITIES

a MATCH STICK



dwarfs this PERFEX gage

The comparison between Perfex's 0-80 Male Thread Gage and a match, graphically illustrates what Perfex can do in maintaining fine accuracy even in the most minute gage.

With the high standards required in today's aircraft industry, on all parts regardless of size, manufacturers have come to recognize Perfex's reliability in adhering to the extremely close limits that are being specified.

If your requirements in gages are being held to closer limits why not write us for information on Perfex's line of gages today?

Perfex Manufactures Thread, Plug, Radius, Contour, Profile, Flush Pin, Solid Snap, and Specials to Your Blueprints.

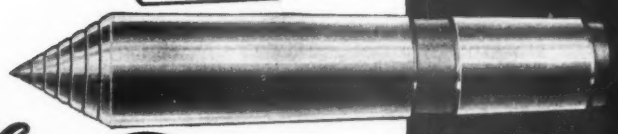
ACCURACY PERFEX OUR CREED

PERFEX GAGE and TOOL CO.
3604 GAYLORD DETROIT, MICHIGAN

for CLOSE TOLERANCES

RIGID SUPPORT
No balls, rollers, or races to wear out and cause uneven tooling.

BETTER LUBRICATION due to exclusive helical groove*



Use CMD *Helical Groove* **CENTERS**

AND

CMD CENTER POINT OIL

★ The exclusive left hand helical groove in CMD Centers holds a reserve supply of lubricant and conveys it constantly to the extreme point of center. No burned out centers! No stopping machine to relubricate centers!

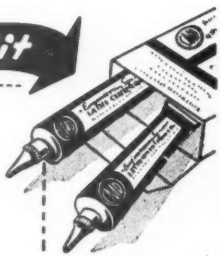
When CMD Helical Groove Centers are used with CMD Center Point Oil, they can be drawn up tight against the work, permitting closer tolerances and finer precision results. Send coupon now for details and FREE sample kit of the oil.

Write for FREE *Sample Kit*

CHICAGO MANUFACTURING & DISTRIBUTING CO.
Dept. 9J, 1928 West 46th St., Chicago, Ill.

☐ Send circular on CMD Helical Groove Centers
☐ Without obligation to us, send FREE sample kit containing a tube of CMD CENTER POINT OIL and a tube of CMD CENTER POINT LUBE (grease) with directions for making an amazing, simple test.

NAME .....
FIRM NAME .....
ADDRESS .....



Friction— AND IT BURNS!
Friction
makes a Dead Center
burn too . . .
often ruining the work
as well as the center
MOTOR TOOL
Ball and Roller Bearing
LIVE CENTERS
reduce friction to
a negligible degree
BUY
UNITED
STATES
WAR
SAVINGS
BONDS
STAMPS
MOTOR TOOL MANUFACTURING CO.
METAL CUTTING TOOLS
7779 CORTLAND AVENUE • DETROIT, MICHIGAN
Make it a Rule
to Call Motor Tool

EX-CELL-O CYLINDER BORING MACHINE

To left: Ex-Cell-O angular type machine equipped with six spindles to finish bore valve seats and valve guide holes in cylinder head of aircraft engine on a production basis. Each spindle is individually adjustable for depth of cut, as are the tools in the boring bars (boring bars, not shown in picture, are piloted in the fixture).

SPECIAL MACHINES

...for today's production... and tomorrow's

For years Ex-Cell-O has been familiarly known as "the headquarters" for special single-purpose machines for turning out accurate parts at a high rate of speed . . . machines that frequently perform numerous operations in one setting of the work and often bring not only a substantial increase in the number of parts produced hourly but also improved quality and reduced unit cost. . . . This is why so many manufacturers have turned to Ex-Cell-O for equipment to meet their war production schedules; why Ex-Cell-O designed machines will figure in the post-war plans of an increasing number of American industries. . . . If you are planning for tomorrow, when the new standards will necessitate costs that are competitive, take advantage of the wide engineering experience and extensive manufacturing facilities that for many years have made Ex-Cell-O a leader in the precision machine tool field.

EX-CELL-O CORPORATION • DETROIT, MICH.

EX-CELL-O SIX-WAY MACHINE

Below: Ex-Cell-O six-way machine for drilling, broaching and reaming valve guide holes in a magnesium crankcase. This machine is equipped with four standard hydraulic power units and two Ex-Cell-O special hydraulic broaching units.

XLO

EX-CELL-O *for* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS

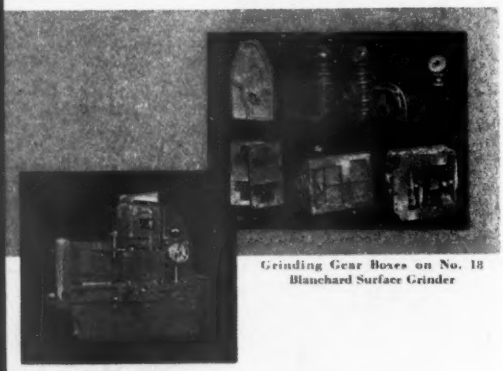
BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ Production
Adaptability
Fixture Saving
★ Operation Saving
Material Saving
Fine Finish
★ Flatness
Close Limits

★ . . . . Especially valuable on jobs like the one illustrated.

"PUT IT ON THE BLANCHARD"



Grinding Gear Boxes on No. 18 Blanchard Surface Grinder

Here is a good example of the way Blanchard No. 18 Surface Grinders are eliminating hand scraping on parts which require flat surfaces for oil-tight joints.

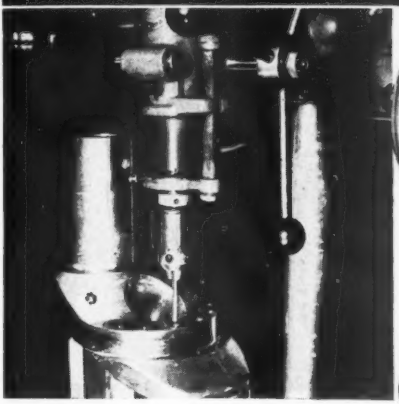
1/64″ of stock is removed from two sides of high strength cast iron gear boxes with oil-tight joint. Fifteen 12″ x 12″ x 3″ boxes (30 surfaces) are produced per hour.

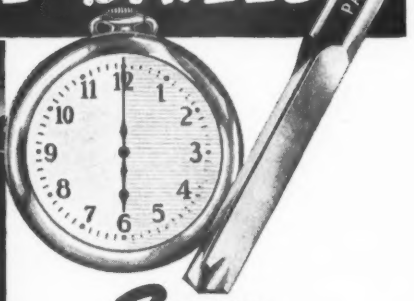
A Blanchard No. 18 Surface Grinder with 36″ magnetic chuck and a column extended to take 18″ work is used, together with a Blanchard Sectored wheel, manufactured by The Blanchard Machine Co.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS., U. S. A.

"HARDSTEEL" DRILLS PAT'D.





Save 6 Hours Time

. . . Removing Broken Tap from Wright Crankshaft!

In the plant of one manufacturer of Wright crankshafts, "HARD-STEEL" drills are saving time and giving 100% parts recovery when taps break in blind holes.

FORMER PRACTICE

Grinding out tap with pencil grinder — time 8 to 8½ hours — frequent loss of the part when grinder defaced threads.

PRESENT PRACTICE

Drill about ⅛ inch into tap with a "HARD-STEEL" drill—enlarge hole by grinding—drill again—grind and continue until tap is cut out. Time 2 to 2½ hours—no loss of parts.

This is just one of hundreds of applications where the ability of "HARDSTEEL" drills to drill, ream, countersink and counterbore steels hardened by any process pays big dividends.

Ask for a copy of the "HARDSTEEL" Operators Manual — 24 pages of practical information that will prove the value of "HARDSTEEL" tools in any service shop. Free on request.

BLACK DRILL CO. • 5005 Euclid Ave., Cleveland, O.

"HARDSTEEL"

DRILLS · REAMERS · TOOL BITS · SPECIAL TOOLS

A McKinney built three position rotary fixture for drilling and reaming of airplane engine parts.

WITH McKINNEY TOOLING

THE term "in jig time" always implies speed but here at McKinney's it has a dual meaning.

To assure great output of parts profitably, speed and facility of operation are built into every tool, jig and fixture. But these objectives are never attained at a sacrifice of extreme accuracy. Pride of craftsmanship is paramount in every department even to uncommonly fine finishing of completed tools before shipping.

McKinney responded to the call for tremendously increased war production with decades of experience as machine designers, tool makers and manufacturers.

Today, the McKinney organization of several hundred engineers and tool makers is shipping tools, jigs and fixtures to both coasts, to Canada and as far south as Texas.

We'll gladly quote on building any tool already designed or have one of our engineers call to discuss problems of tool designing. Call upon us.

McKINNEY TOOL & MFG. CO.
CLEVELAND

DESIGNERS and BUILDERS of PRECISION TOOLING
Since 1920

1673 ARABELLA ROAD

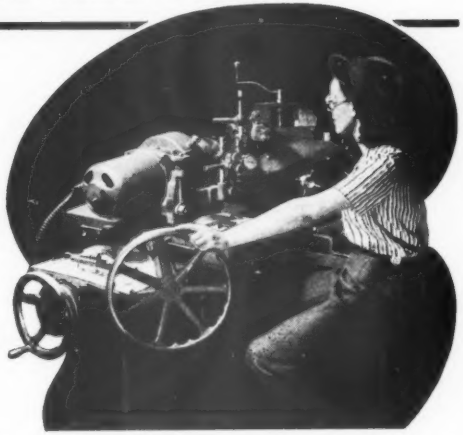
Tools·Dies·Jigs·Fixtures·Special Machinery

THE MILWAUKEE FACE MILL GRINDER GIVES YOU *ALL* THREE!

1. UNUSUAL RIGIDITY

2. REDUCED SHARPENING TIME

3. ACCURACY TO WITHIN .0002 PER INCH



THE basic design of the Milwaukee Face Mill Grinder embodies strength, precision, and capacity. It is capable of sharpening Tungsten Carbide Cutters ranging from 3" to 16" in diameter—grinds the blades to within .0002 per inch.

Set-ups are quickly made with graduated dials, facilitating adjustments. Other controls are handily located for simplified operation.

OTHER IMPORTANT FEATURES:

1. Jeweled bearing dial indicator for accurate checking.
2. Finger tip control.
3. Fine thread precision saddle screw.
4. Hand screw permits angular setting of 15° on either side.
5. No adapters necessary.
6. Spindle has No. 50 National Standard Taper.
7. Blower system at slight extra cost.

Reject the Source of the Error . . . not the Finished Product . . . USE CENTER SCOPE!

The Center Scope is an optical locating machine shop tool, constructed for use on any machine from jig borers to bench drills. No technical knowledge or training is needed to use it. It is a necessary production tool—necessary today because you are interested in saving time—tomorrow, because you will be interested in saving cost.

Built in various models; variable and rotating Center Scope priced at $97.00, with taper shank, $125.00; Special Center Scope, $125.00—Edge Block, $23.00 additional.

Write Department CS, for complete information.

KEARNEY & TRECKER PRODUCTS CORPORATION ● *Milwaukee, Wisconsin*

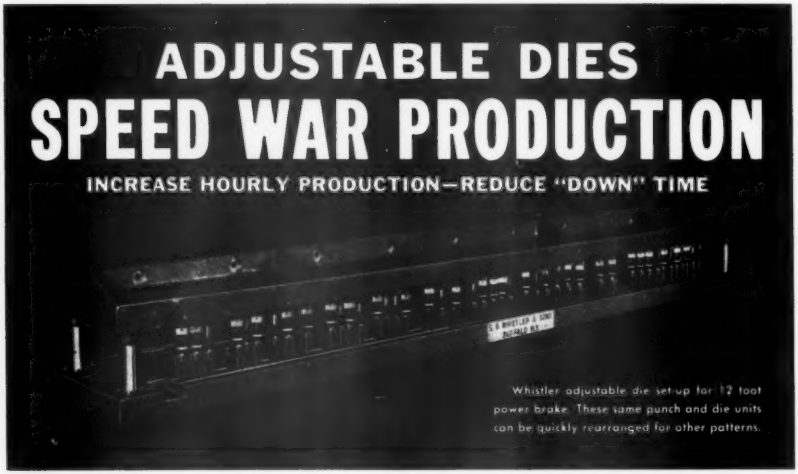
Rotary Head Milling Machine
Autometric Jig Borers
Center Scope

Kearney & Trecker *Products*
CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
Milwaukee Midgetmill
Milwaukee Speedmill

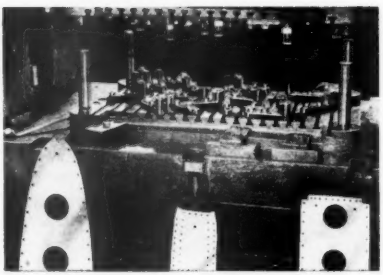
ADJUSTABLE DIES
SPEED WAR PRODUCTION

INCREASE HOURLY PRODUCTION—REDUCE "DOWN" TIME

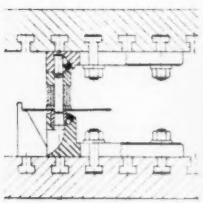


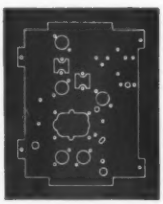
Whistler adjustable die set-up for 12 foot power brake. These same punch and die units can be quickly rearranged for other patterns.

Whistler Adjustable dies are saving the day in war plant "speed-up" schedules by...saving weeks of time normally required in single purpose die making...units can be used over and over in different patterns...new set ups on or off the press in minutes ...all parts interchangeable...work on any type press...perfect precision on long or short runs...no special tools and new workers quickly learn to make press changes.



Another grouping of Whistler Adjustable Dies illustrating re-use of same units. Note close grouping of perforations.





Side view showing construction detail of U-50 Whistler Adjustable Punch and Die unit and typical example of perforated and notched piece produced by Whistler Dies.

Over 25 Years of Tool and Die Making Experience

S. B. WHISTLER & SONS, Inc.
752-756 MILITARY ROAD BUFFALO, N. Y.

Every Production Executive needs this fully illustrated catalog. Sent upon request.

"I'll Take This One"

● And with a DOALL Saw in his hand, he's making a good choice, because DO-ALLS are up-to-the-minute, hard-toothed and will increase cutting efficiency to an amazing degree.

No matter what you saw — metals, alloys, plastics, magnesium, aluminum, plywood, laminated materials, builders board, rubber, wood, etc. — there's a DO-ALL Saw specified for that material. No hit or miss, the right saw for the job, every time.

These Band Saws, first designed to fit DO-ALL Contour Machines, are now available for most any sawing machine. 100 feet in each metal Strip-out box.

FREE LABORATORY TESTS

The DO-ALL Research Laboratory is at your service. Send your tough cutting problems for the DO-ALL engineers to solve. You'll receive promptly a written report of their findings and recommendations.

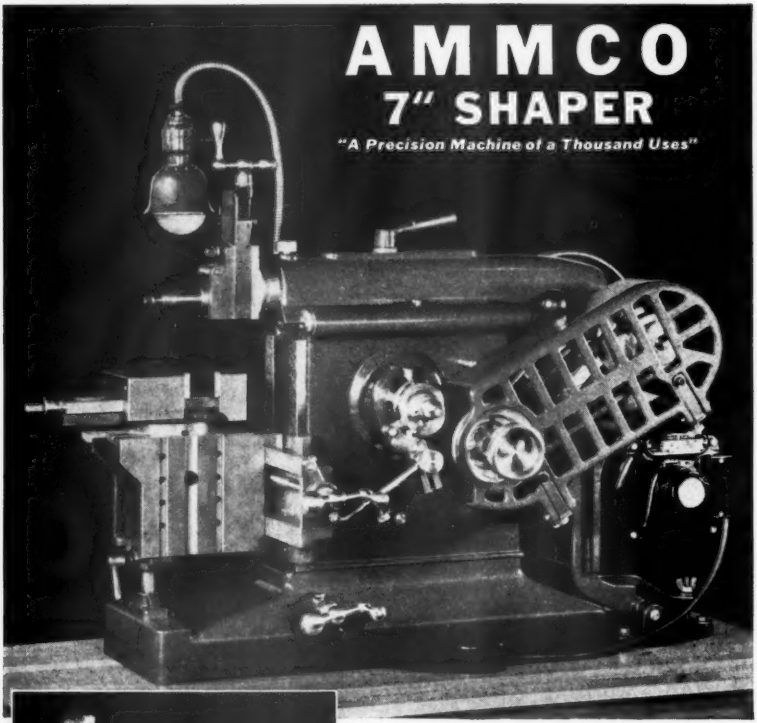
Send for new DO-ALL Band Saw circular.

THE DOALL COMPANY

1203 THACKER STREET DES PLAINES, ILLINOIS

DO-ALL Offices in 25 cities, with a staff of trained engineers to give you quick service on Band Saws and Files, Contour Machines, Gage Blocks and Surface Grinders.

AMMCO
7" SHAPER
"A Precision Machine of a Thousand Uses"



IT'S PORTABLE

- **Saves time and steps!**
- **Can be moved from job to job in tool and die shop!**
- **Just wheel up to bench--plug in--and go to work!**

On jobs requiring a stroke of 7" or less, the AMMCO 7" PRECISION SHAPER will enable you to save a lot of time and expense in a set-up which would be required for larger shapers. Furthermore, the AMMCO will enable you to get away from the cost of operating a big shaper on small work.

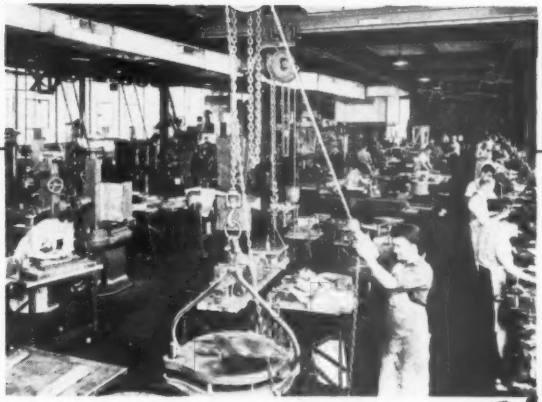
Portable Cabinet model enables this shaper to be moved about the shop.

•

Write today for specifications and prices

ARMY E NAVY

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Ave.—North Chicago, Illinois, U. S. A.



ESSENTIAL EQUIPMENT *Now*

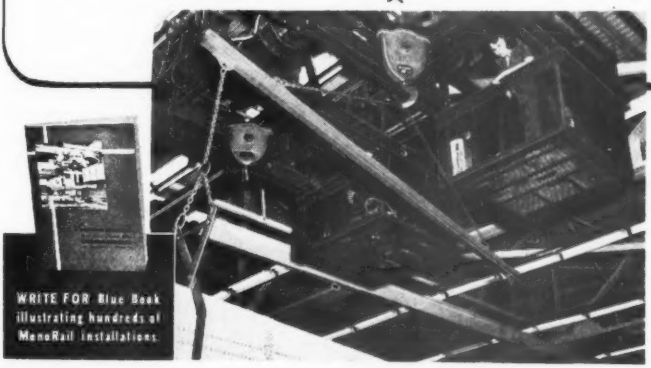
that is your solution to post-war conversion

★First we must win this war. American MonoRail Overhead Handling Equipment is doing its part in increasing war production. American MonoRail equipment is extremely flexible. Standard parts fit quickly and easily into complete systems, offering an extremely wide range of application without costly adjustment or lengthy engineering.

Let our engineers show you how to speed up your war production NOW and at the same time prepare for post-war conversion.

THE AMERICAN MONORAIL CO.

13131 Athens Avenue ★ Cleveland, Ohio



Production at New Peak on
JOHANSSON GAGE BLOCKS

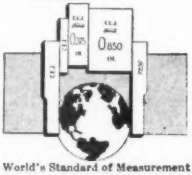
Deliveries on Priority Basis Now Being Made With Less Delay Than Formerly

REQUIREMENTS of extreme manufacturing precision in war industries of the United Nations have made unprecedented demands upon our output of Johansson Gage Blocks, and we regret that our customers have had to wait so long for delivery even though every order is on priority.

Today, we are happy to announce that increased manufacturing facilities have stepped up production to the highest peak in history and the period of waiting for deliveries has been greatly reduced. Yet production must always be limited by the accuracies to which these blocks are built. Even now, it is not possible to promise immediate deliveries. But it is smart to place your order now. If it is on file, your chances of getting early delivery are a great deal better than they have been heretofore.

JOHANSSON GAGE BLOCKS
AND ACCESSORIES

Ford Motor Company, Johansson Div.
Dept. TD9 Dearborn, Michigan



World's Standard of Measurement

REMOVE MORE METAL PER DAY WITH TECO *Cemented Carbide*

...cut at higher speeds

... hold cutting edges longer

...produce more pieces between grinds

... reduce grinding and re-tooling time

You're "in the chips" more ways than one, when you use TECO Cemented Carbide. Because it stays on the job longer between grinds, TECO Carbide spends more productive time removing metal—less down time for re-tooling. Consequently, you produce more pieces per machine, per day.

This greater resistance to wear and breakage comes from the rigidly controlled density, hardness and uniformity of TECO Cemented Carbide. Available in grades, styles and sizes for practically every machining operation. Let us know your needs. Write for detailed catalog.

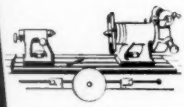
TUNGSTEN ELECTRIC CORPORATION • 574 39th Street, Union City, N. J.

Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Representative: Architects & Builders Bldg., Indianapolis, Ind.

TECO *Pioneers in Tungsten Carbides for over a Quarter Century* TECO **CEMENTED CARBIDE**

ABRASIVE
ACCESSORIES

℞
MORE WORK · · BETTER WORK-
FROM YOUR PRESENT MACHINES



Originally designed to increase and improve the work of *Abrasive* Surface Grinding Machines, the Accessories and Attachments listed below are serving efficiently not only on *Abrasive* Machines, but on many other machines of various types. Made to the same high standards as all *Abrasive* Products, they are saving time and boosting production in many machine shops.

EXHAUST ATTACHMENT
WET GRINDING ATTACHMENT
VISE, PLAIN
VISE, SWIVEL
RADIUS TRUING DEVICE
RADIUS & ANGULAR TRUING DEVICE
8" INDEX CENTERS
SEMI-AUTOMATIC INDEX CENTERS
WHEEL COLLETS FOR ABRASIVES

12" & 18" RING WHEEL CHUCKS
CORTLAND SEGMENTAL WHEEL CHUCKS
DEMAGNETIZERS
D. C. GENERATOR *(Belt Drive)*
MOTOR GENERATOR SET
MAGNETIC CHUCKS
HIGH SPEED ATTACHMENT *(Liberty Tool & Gage)*
ROTARY GRINDING ATTACHMENT
12" for Abrasive #34
6" and 8" for Abrasive #3B and #1½

Write for further information and prices on specific equipment

HELP YOUR OPERATORS REDUCE SET-UP TIME AND INCREASE PRODUCTION

ABRASIVE MACHINE TOOL CO.
Dealers in Principal Cities
EAST PROVIDENCE · RHODE ISLAND

MATTISON ABRASIVE BELT GRINDING AND POLISHING MACHINES

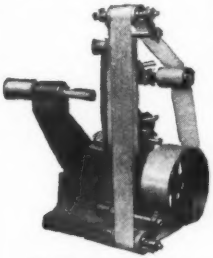
★ Results obtained in a number of plants definitely establish the use of factory-coated abrasive belts as a most efficient practice. Besides reducing the number of rejections and improving the finish, they have cut the polishing cost per piece through increased production.

However, to secure full benefit from factory-coated abrasive belts, the right type of mechanical unit is necessary. The machine is all important for properly applying the abrasive to the particular job to be done.

Mattison Abrasive Belt Grinding and Polishing Machines are engineered with a knowledge of the factors involved to give the best application of belts. From the time factory-coated abrasive belts were introduced for metal grinding and polishing, Mattison's have developed and built machines to provide best results.

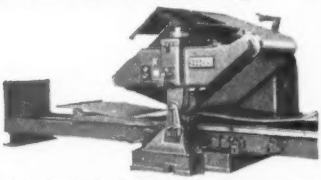
They are built for both the wet and dry grinding method. In addition to the finishing of metal parts, they are used for plastics, hardened rubber, fibre, glass, etc. In fact, the applications are so numerous, only a few can be mentioned and shown on this page.

Whatever your problems may be, it is well worth while to make an investigation as to the machine available for handling it.

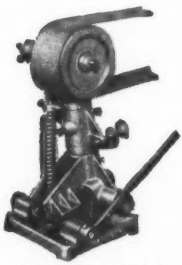


Mattison J-115 Variety Belt Grinding and Polishing Machine for flat and curved surfaces.

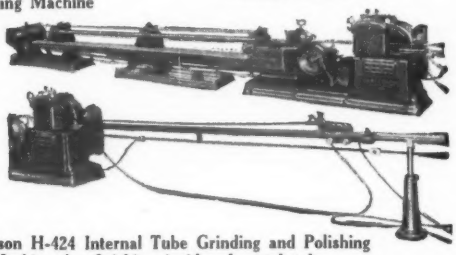
Mattison S-441 Grinding and Polishing Machine



Mattison W-455 Wide Belt Grinding and Polishing Machine.



Mattison J - 135 Idler Stand and Pulley adapts regular polishing jack to the use of factory-coated abrasive belts.



Mattison H-424 Internal Tube Grinding and Polishing Machine for finishing inside of metal tubes.

MATTISON MACHINE WORKS – ROCKFORD, ILLINOIS

HERE'S HOW "SUTTONIZING" RECLAIMS your broken H.S.S. CUTTING TOOLS

BEFORE

6" x 5" x 2" slab mill with teeth fractured.

AFTER

Same slab mill as reclaimed by "SUTTONIZING". Also rough ground.

Here are some typical tools reclaimed by "SUTTONIZING". Fractured teeth can be repaired on the following: shell mills, large size end mills, plain mills, broaches (subject to our approval), side mills (cracked 4" O.D.—low limit), boring, slotting, cut off and turning tools repaired or fabricated.

"SUTTONIZING" has earned and is holding this "top spot" in the welding reclamation of H.S.S. cutting tools. Tough jobs have not slowed down "SUTTONIZING"—but rather have boosted its popularity unbelievably in the year that it has been used for salvaging most all types of difficult to repair H.S.S. cutting tools. Wire or write for our catalog describing the "SUTTONIZING" method.

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CONSERVE TOOL STEELS FOR VICTORY
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SEND FOR CATALOG TODAY

This catalog shows actual photographs of reclaimed tools.

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D.R.&T. CO.

ESTABLISHED 1938

The manufacturing facilities of Detroit Reamer & Tool Co. offer the most modern present-day equipment.

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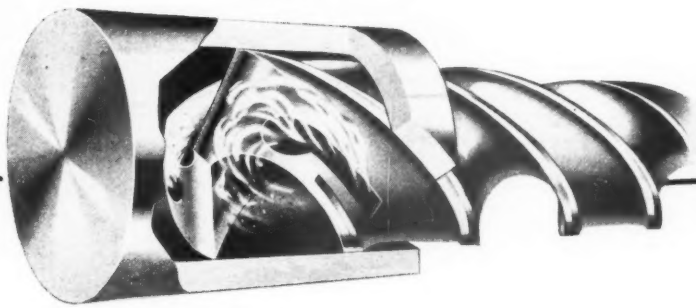

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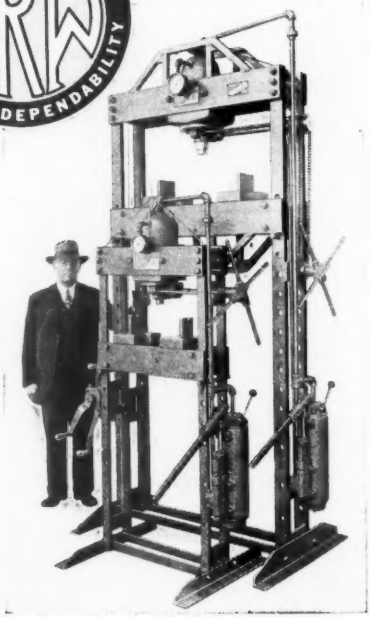
PAN AMERICAN USES KRW EQUIPMENT TO

"Keep 'em Flying"

Illustration at left shows a KRW 3-ton Bench Type Arbor Press in use in Pan American shops.

Illustration below shows a special extra high 75-ton KRW Hydraulic Arbor Press in comparison with the standard 25-ton unit.



SINCE 1916 KRW A MARK OF DEPENDABILITY

● Girdling the globe as it does, and with every Clipper serving some phase of the war effort, Pan American insists on the best possible equipment in its shops — to speed overhaul and increase the number of trips per plane per month. That you find them using KRW Arbor Presses and other equipment is further proof of this policy.

KRW Hydraulic Arbor Presses are Engineered for War Production. Hundreds of them have already been speedily adapted to handle many unusual production jobs — without time-consuming engineering delays. KRW builds standard Hydraulic Arbor Presses in 25, 50, 60 and 75-ton capacities and Bench Type Arbor Presses in 1/2, 1 and 3-ton capacities.

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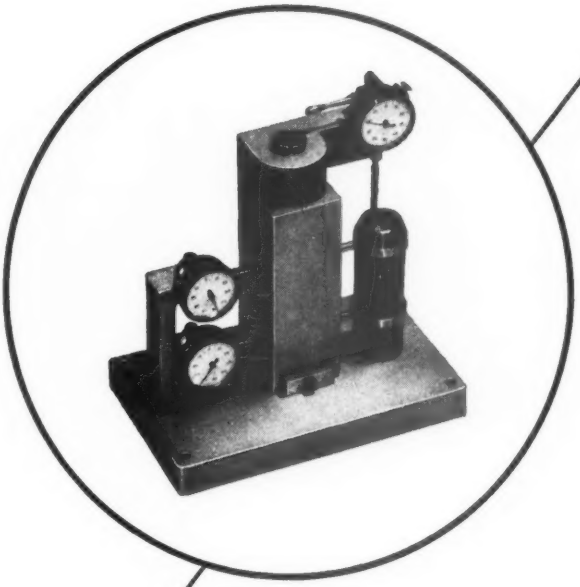

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by TURNER

Illustrated above is a Special Gauge made by Turner. This gauge is just one of the hundreds of Special Precision Gauges Turner makes for manufacturers who require their own particular type of gauge to check certain precision operations on their production lines. Turner's Engineering Department has played an important part in assisting in the design of these gauges and the Turner Company invites you to write them if you have a checking problem that requires a special built gauge.

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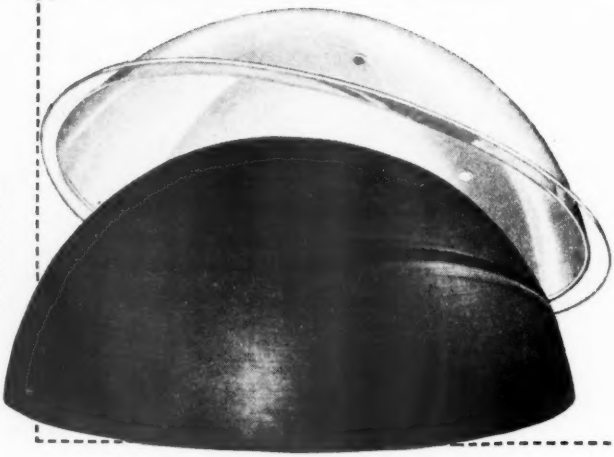

This photograph, taken at Bell Aircraft Corporation, shows laminated Masonite Die Stock used as a mold for forming transparent plastics.

Widely popular for mating dies, forming blocks, templates, jigs and fixtures, Masonite Die Stock also is now being used for molding transparent plastics—to speed production of gun turrets and nose coverings in war planes.

Masonite Die Stock can be easily laminated to any thickness for any type or size of mold . . . saves time and money in turning and tooling . . . will not split, check or crack.

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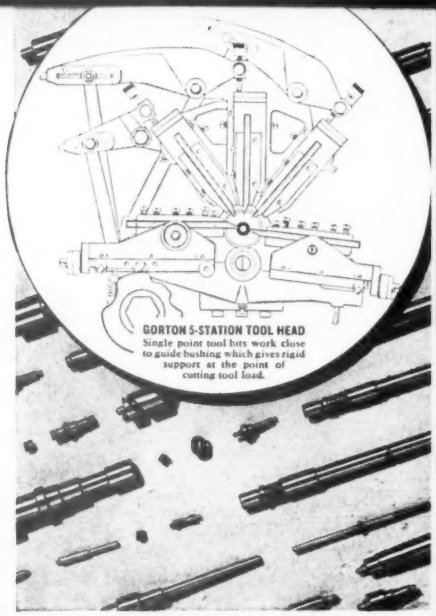
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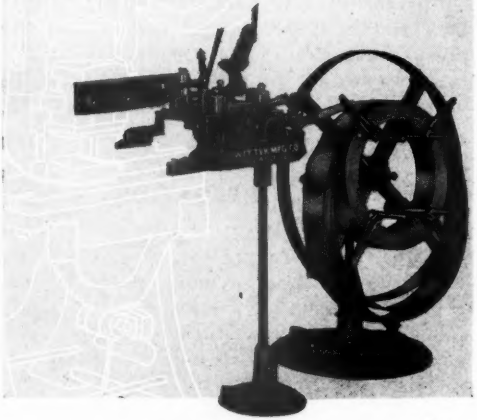

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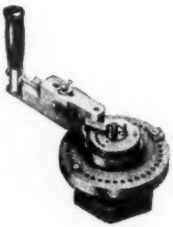

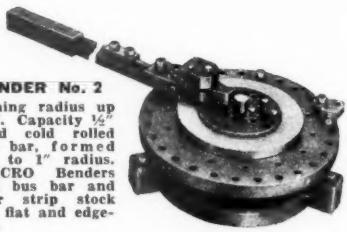

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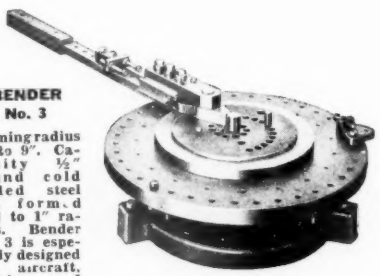

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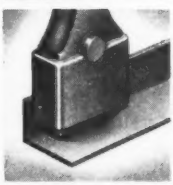

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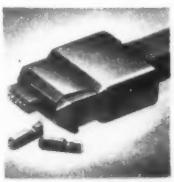

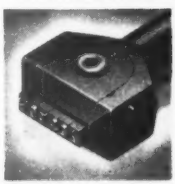

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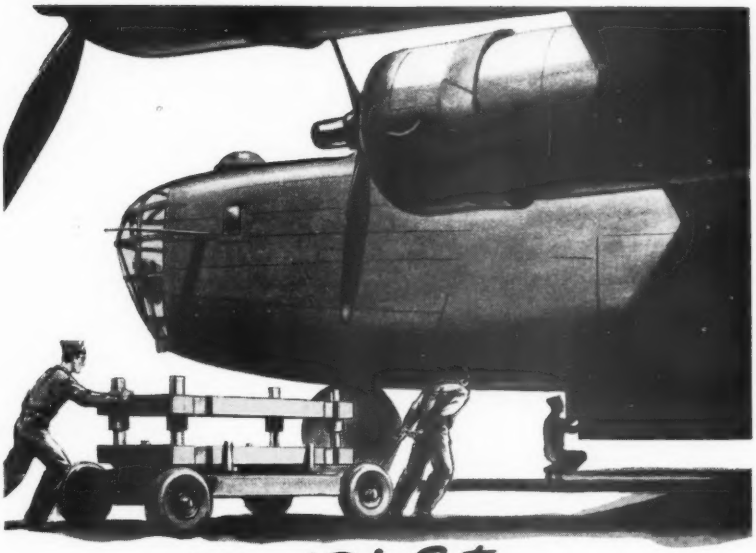

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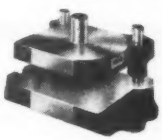

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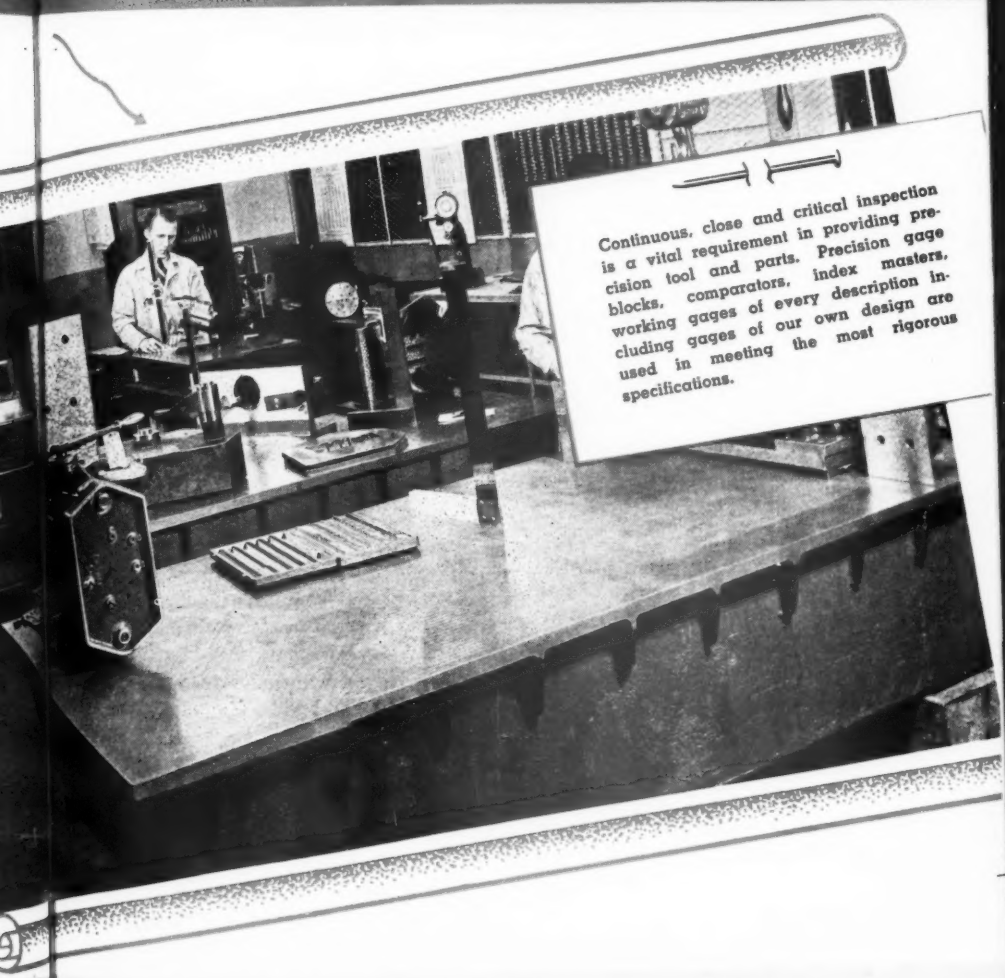

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After having spent his early years in the very birthplace of precision measurement, Elmer Ellstrom desired more experience in methods used in the steel-working industry and in 1904 came to the United States where he found

FINEST GAGE BLOCKS

1943

● PLANT WHERE CHROMIUM PLATED GAGE BLOCKS WERE ORIGINATED (the only major improvement since their origination).

employment with large manufacturers in this country, such as Westinghouse, Mesta Machine Company, Joseph Bullard Company and the Martin Bomber Company.

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Yes, the manufacture of gage blocks is truly "a family tradition" with the Ellstrom family and it is undoubtedly the reason why Dearborn Chromium Plated Gage Blocks are known for their superiority throughout the world.

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Originators of Chromium Plated Gage Blocks

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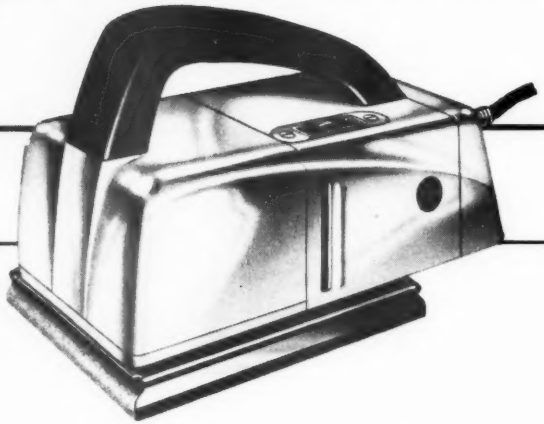

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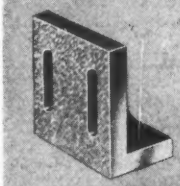

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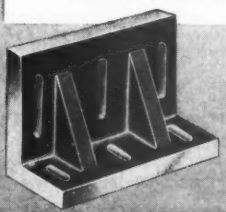
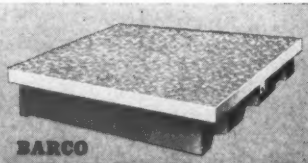
BARCO ANGLE IRONS





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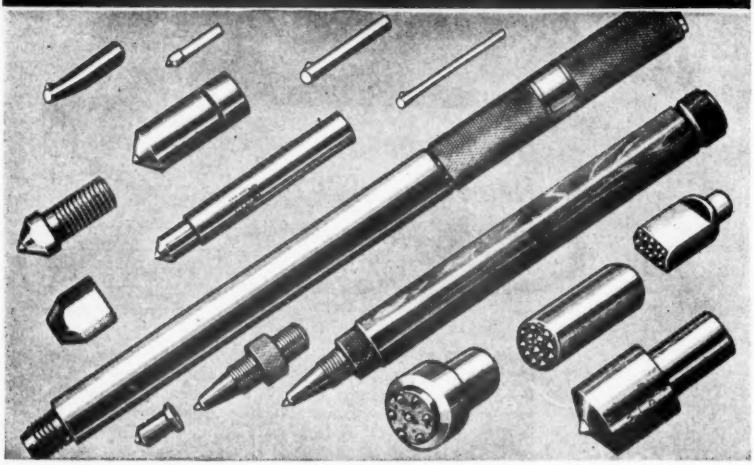

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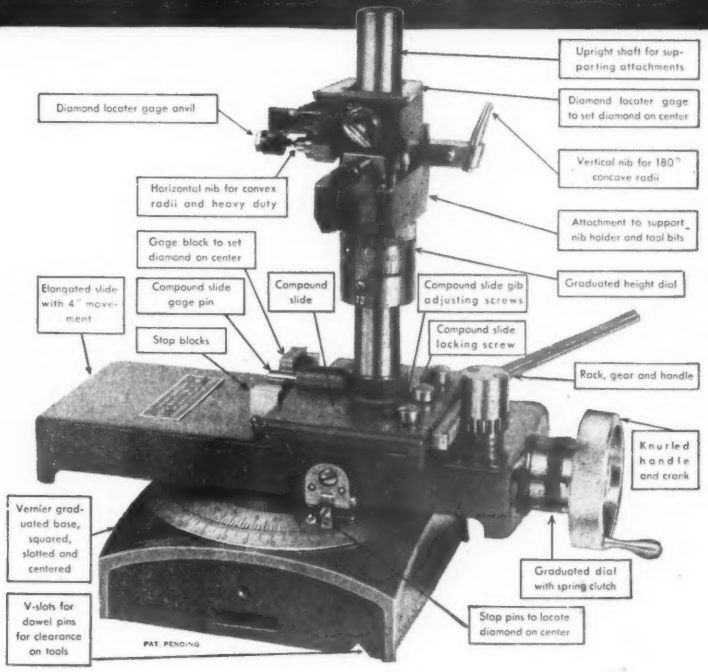
Upright shaft for supporting attachments
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Diamond locater gage to set diamond on center
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Attachment to support nib holder and tool bits
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According to Government figures, more than 9 million workers who have had no previous metal-working experience are today using cutting tools. Inevitably this results in much waste of time and tools, slowed-up operations, work-spoilages and shut-downs, for tool replacement and grinding.

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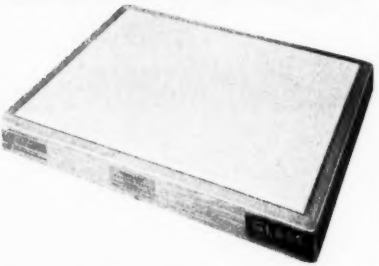

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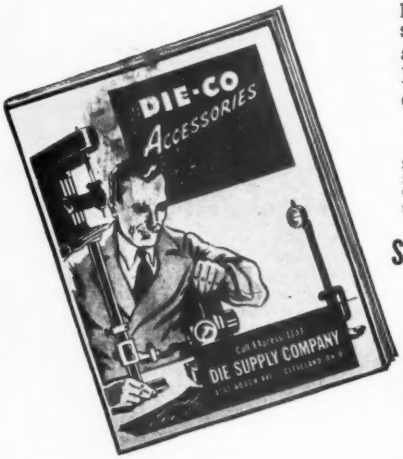

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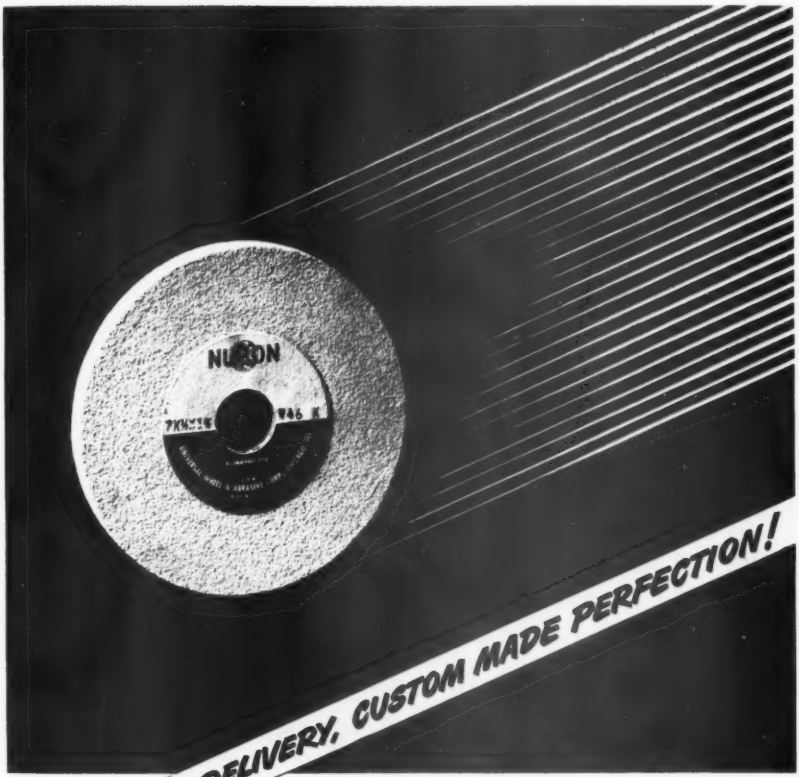

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INDUSTRY Gets Down To PLANNING

THE most important requisite to making our economic transition from war to peace a genuinely successful process will be the continuance of employment at a high rate.

Most of us can be buyers only when we are gainfully employed or profitably engaged in business or in a profession. Thus we acquire spendable income, the fuel that develops purchasing power which in turn generates buyer demand. And it is buyer demand, actuated by the willingness of the American wage earner and the business man to spend their earnings and profits, which in times past has built and sustained our marvelous production.

So stated, the formula for peacetime prosperity seems a simple one. But in actual practice it does have its kinks and snarls. Let the engine in your car get out of balance, a too rich or too lean gas mixture, and you have a reduction in power and eventual failure. 1929 with its excesses illustrates such an out-of-balance condition in our National economy.

In 1933 we tried to readjust this unbalanced economy by Government-financed *make-work* projects intended to artificially provide spendable income to develop purchasing power which would "re-activate" production of both consumer and capital goods.

Last month we reminded our readers that achievements bring responsibilities. Establish a record of performance and you create a new standard by which you will henceforth be judged. Industrial management will be expected to demonstrate its utmost capabilities to achieve high postwar production painlessly and promptly. It is every industrialist's responsibility.

The Committee for Economic Development has just issued an especially timely and helpful Handbook entitled "Plan Postwar Jobs—*Now*." We are seeing it for the first time. We urge our readers to study it. We cannot consistently disagree with either its proposals or its conclusions because last month and in prior months we urged similar ones upon industry as a whole and upon every employer specifically.

The individual plant executive will find in the Handbook "a stimulating and far-reaching program for manufacturing and allied businesses—one designed to put useful ideas into motion —ideas covering every business process from the mining and growing of raw materials to the final utilization of products by the ultimate consumer." The potentialities of our postwar

business volume are summarized from U. S. Department of Commerce records and particularly from "Markets after the War—An Approach to Their Analysis", prepared by S. Morris Livingston.

Using prices current in 1940 it is estimated that in 1946 we can produce $142,000,000,000 of goods and services. This would be an increase of 46% over 1940 when the total was $97,000,000,000. By comparison our totals for 1941, '2 and '3 are respectively 119.0, 151.6 and 188.0 (estimated) billion dollars. Actual commodity prices in these years have been used and it should be remembered that they have advanced substantially from the 1940 level.

The 1946 estimate of business volume assumes maximum employment of American manpower, allowing for only 2,000,000 unemployed but also for 1,900,000 still to be in the Armed Forces. In 1940 we had 9,000,000 unemployed and Army and Navy personnel totaling 600,000. Thus 1946 is to be considered a year of full peacetime operation—the first. If peace comes to us earlier, adjustments will have to be made accordingly.

The necessity for orderly transition of industry's operations from war products to those of peace provides right now a most unusual opportunity for Trade Associations to demonstrate their true worth. Research and planning are vital activities which if carefully and intelligently carried on will benefit not alone the members of that one industry but likewise all other groups with whom they cooperate.

Now is the time to realize that no man knows when peace will again return to us, not even the month or the year. In 1941, when we decided to aid the democratic fighting nations, we really were in a state of undeclared war. Similarly, if peace "sneaks" up on us let's be prepared to take over.

American Labor Unions are making progress in their study of postwar job prospects. If their research tends to show that Industry will not wholeheartedly or cannot efficiently organize itself to make the changeover without undue hardship to labor, there can conceivably be pressure for legislation which will again set up make-work projects or even provide for more direct forms of payment which would further increase our tax burdens.

We want peace. Then right now is the time for every manufacturer, merchant, banker and every individual, to plan what he and his firm will do to promote its benefits.

Editor and Publisher

This message comes from Washington where Mr. Huebner is serving as Chief of the Tooling Branch, Facilities Bureau, War Production Board.

FILING PRACTICE

Grant O. Loader
GENERAL SUPERINTENDENT
Heller Bros. Company
Newcomerstown, Ohio

THE date of the file's invention and by whom it was conceived is not known. The earliest record of a file is found in the Bible. The 21st verse of the First Book of Samuel reads as follows: "Yet they had a file for the mattocks and for the coulters and for the forks, and for the axes, and to sharpen the goads."

From this we learn that files were in use more than 3,000 years ago.

Manufacturing Technique

The manufacture of modern files consists of from twelve to thirty operations depending on the type and cut.

Taking the major ones in sequence, the forging or shaping of the blanks comes first.

Power driven hammers were developed for this work. Later, rolls were perfected, first, for shaping the points, then for the tangs also.

Annealing is one of the most important processes entering into file making. This operation is for the purpose of reducing the forged blanks to a uniform softness to facilitate tooth forming or cutting. The modern electrically heated and controlled furnaces give results in consistent uniformity undreamed of by the early craftsman.

Grinding of the blanks has, as far as can be learned, always been done on natural sandstones. Lately, however, synthetic stones have been coming steadily to the front for this operation.

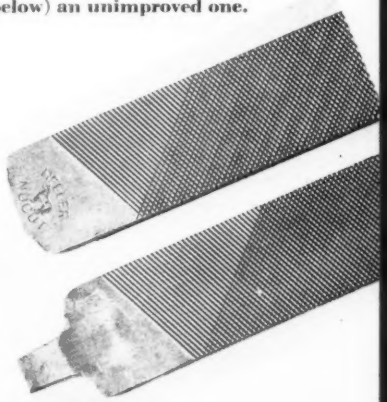
The blanks, as they leave the grinding machines, appear very smooth and level. But they are not yet in proper condition for cutting the teeth. To make them so, a draw-filing or stripping operation is necessary. The result is a perfectly flat and smooth surface, ideal for forming or cutting uniform teeth.

This was followed by a much superior improvement, a method to a very limited extent still in use today, consisting of using a triangular shaped chisel, the apex of which is exactly above the center of the cutting edge. This chisel is held between the fingers and thumb, and placed in position on the point of the file blank, which in turn is securely held on a lead or zinc strip by leather straps with tension supplied by the foot.

The force needed to form or raise the tooth is supplied by what hand cutters term an elephant-nosed hammer. This hammer has the handle set at an approximate angle of 60° to the head, and the striking face is at about 70° angle to the head. This places the face at a 50° angle to the handle.

The reason behind this irregular shaped hammer is that it delivers a harder blow with less effort than is possible with other types of hammers.

Fig. 1—Shows the contrast between (above) an improved file and (below) an unimproved one.



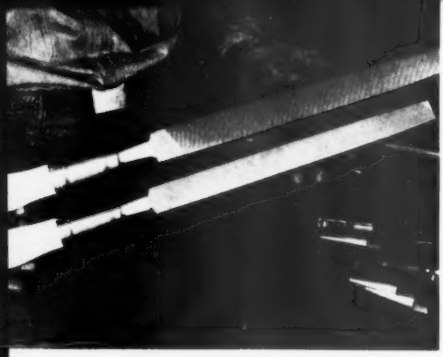


Fig. 2—Files should be firmly driven into good handles.

It is also necessary that the blow be struck at about a 20° angle to the file surface in order to give the proper slant or rake to the teeth.

After the first tooth is raised, the chisel is lifted and positioned for the next one, and so on until the cut extends from point to shoulder.

An average hand cutter strikes around 100,000 blows a day in finishing 15 dozen 10″ Mill files. So it is easy to understand why the above described hammer was developed.

The accuracy and uniformity of these hand cut files are such that only highly skilled file technicians can distinguish them from those made on modern machines; and in efficiency they were without equal until the cutting machines were brought to a high state of perfection.

Great progress has been made in all operations of file manufacture, but the improvements in cutting or forming the teeth are outstanding because it is the most important and highest skilled operation entering into their manufacture.

The evolution of hardening is comparable to that of annealing. The old eye-gaging practice of heat control has been replaced by ultra-modern electrical methods assuring perfect results.

First, the files are cleaned of oil and grease; then, in order to prevent oxidation of the teeth, they are coated with a specially prepared paste.

Electrically heated lead baths heat the files to over 1400° F after which they are quenched in cold salt brine. This completes the hardening cycle.

As is the case with all other edge tools, files too must be sharpened after hardening.

Automatic sand blasting machines of special design are used for this precision operation, and as the files emerge, they are individually tested by hand with an accurately tempered steel prover for cutting efficiency and hardness.

In recent years several noteworthy changes have been made in file design, outstanding of which is that of variable spacing teeth on the first cut of double-cut files.

On ordinary double-cut files the criss-crossing of the two cuts create straight rows or lines lengthwise of the file which, in use, have a very strong inclination to track or serrate the work. In this improved file, the variable or irregular spacing of the teeth produce not straight but wavy or serpentine lines or rows.

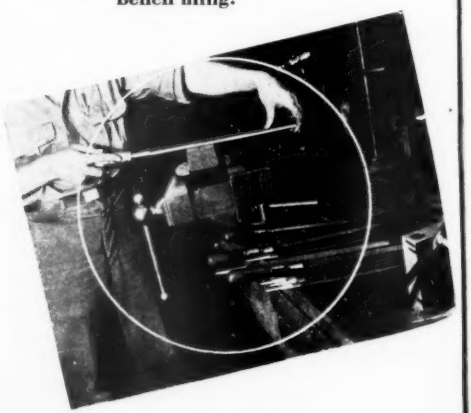
In practice these lines practically eliminate serrations or tracking while at the same time removing more metal than ordinary files.

Prior to the introduction of this invention it was common practice to use two files on a job, a double-cut one for roughing out the work, then a finer one for the finish.

There is a file for practically every need imaginable; therefore, the first and most important consideration should be to select the one best adapted to the work.

To describe each type and kind of file would require far more space than is

Fig. 3—Elbow height is best for average bench filing.



here available inasmuch as their number reaches into the thousands.

To more or less generalize then, only the more popular shapes and kinds will be described. They are as follows:

American Pattern Files

Mill Files: For sharpening circular and mill saws and countless other jobs where a smooth finish is required.

Taper Saw Files: Used in sharpening hand and band saws of all types. Can also be used for a wide variety of other jobs.

Select one having a width at least twice the depth of the saw teeth on which it is to be used. For filing band saws choose Bandsaw Taper or Bandsaw blunt. Their edges are rounded which in turn produces a rounded gullet in the saw teeth, thus resisting breakage.

Flat Files: For general utility work in machine shops, factories, and wherever rapid cutting is required.

Hand Files: Same as Flat Files except they are parallel in width and have one safe or un-cut edge.

Half Round Files: Supplied in the same cuts as Flat Files. The backs are rounded for use in holes, grooves corners, etc. Many machinists and repairmen prefer these to Flat because of their versatility.

Round Files: Tapered and blunt shapes. Used for enlarging holes, grooves, rounding corners, etc.

Square Files: Made in tapered shapes with all four sides cut; and in blunt shapes with one safe or un-cut side.

Used for keyways, grooves, slots, angles, corners, and also for many kinds of surfacing work.

Three-Square Files: These are triangular in cross section. Used for right angles; internal angles; and corner work; for dressing various types of cutters and taps; and for surface work.

Pillar Files: Shaped like Hand files except much narrower in width. Mainly used for keyways, and groove or slotting work. One edge is safe or un-cut.

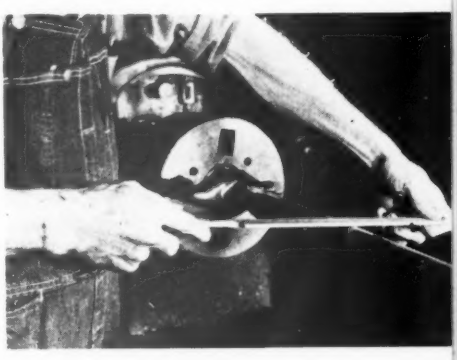
Warding Files: Much thinner than any other flat shaped files, making them ideal for narrow space work of all kinds.

Largely used by tool makers, locksmiths, gunsmiths, etc.

Knife Files: In cross section these are of knife blade shape. Used for much the same purposes as Warding files but the thin edge make them applicable to narrower slots, grooves, etc.

Brass Files: Flat, Hand, and Half Round shapes for filing brass, bronze, and copper work. Very sharp and fast cutting. They clean well and leave an unusually smooth surface.

Fig. 4 — Proper position for lathe filing. Long angle lathe files are best for this work.



Lead Float Files: Flat, Hand, and Half Round shapes. For use on lead and solder.

Aluminum Files: Flat and Half Round shapes for all types of aluminum jobs, such at patterns, castings and sheet work.

Long Angle Lathe Files: May be had in either Flat or Mill blanks. Developed especially for producing exceptionally smooth surfaces on lathe work. The teeth have a much longer angle which gives a shearing action in use. Superior to Mill Files for this class or work. Also extensively used for sheet metal work.

Curved Tooth Files

The Milled Curved Tooth group of files is unique inasmuch as they are the fastest cutting files obtainable. They produce an unusually smooth surface, and readily clear themselves of chips.

Primarily intended for automobile body finishing, their use has rapidly spread to a multitude of other jobs such

Fig. 5 — In precision filing, the work should be higher for better vision.

as aircraft construction, foundries, machine shops, railroad shops, garages, automobile body repair shops and all other types of sheet metal work.

Swiss Pattern Files

The Swiss Pattern line of precision files includes many of the cross sectional shapes of the American Pattern group. But the shapes differ in that the tapered ones have smaller points and a more gradual or longer taper.

The cuts are considerably finer ranging from No. 00 the coarsest, to No. 6 the finest.

Swiss Pattern files are principally finishing files, being used for the final operation on dies and tools.

They are extensively used by watch and clock makers, instrument makers, model makers, gunsmiths, die sinkers, silversmiths and jewelers.

Additional File Information

All tanged files and rasps should be fitted with handles before being used.

Handles made especially for files will be found best and they are obtainable in most hardware stores or wherever files are sold.

Far too many filers and mechanics are inclined to use files without handles. This is not only a very dangerous practice, that may result in serious injury to the hands, but it also lowers efficiency.

New files are exceedingly sharp, therefore only light pressure is required for the first few hundred strokes; then, gradually increased as necessary for the desired penetration.

Many skilled filers rub their new files full of chalk before using which somewhat retards the cutting speed, aids in preventing scratching and produces a smoother finish.

Tallow and beeswax will also be found helpful in this respect.

Machinists are careful in using the proper speeds for milling cutters for they know that otherwise the teeth may be quickly dulled or broken. Much the same rule applies to files. They too will cut better and last longer if the strokes are not too rapid.

The stroke-speed, however, should be varied for different kinds and hardness of metals. Harder metals require a slower stroke and more pressure while on softer metals a lighter pressure and a somewhat faster stroke-speed will be found best.

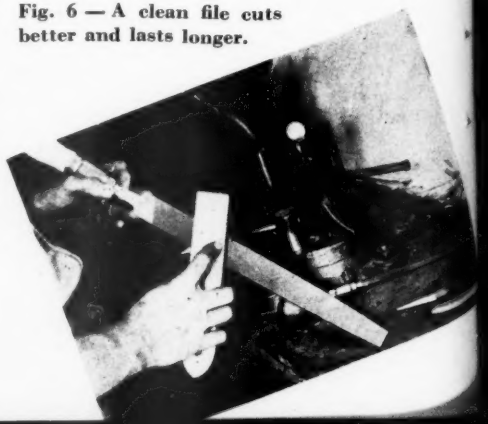
The importance of stroke-speed and pressure cannot be over-emphasized where maximum service and efficiency are expected from the files as well as the filers.

Wherever possible to do so, the object to be filed should be securely clamped in a vise. The filing action or stroke should vary slightly from straight forward to slightly right and left to resist tracking or chattering. When filing across corners use a very light pressure, a diagonal stroke, and avoid riding or backraking the file on the return strokes.

Failure to do this may break off or at least rapidly dull the teeth inasmuch as only a few of them are in contact with the work at a time.

On flat surfaces, however, letting the file drag or slide lightly over the work on the return strokes will usually aid in preventing loading or filling of the teeth with chips.

Fig. 6 — A clean file cuts better and lasts longer.



MODERN DESIGNS FOR DRILLING JIGS AND TAPPING FIXTURES

C. W. Hinman
Designing Engineer

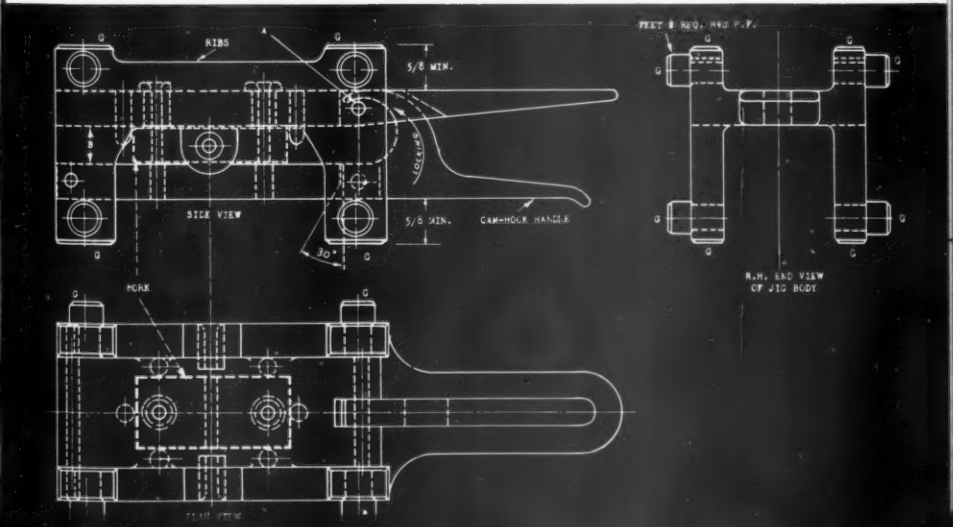
USING SUPPORTING PLATES WITH CLEARANCE HOLES

WHEN drilling "through" holes in work pieces, a supporting plate is used under the work in the jig. The drills break through into clearance holes (10 per cent greater in diameter than the drills) drilled in the plate by a toolmaker. If the metal being drilled is of a "wirey" nature, the edges of the clearance holes will break off most of the drill burrs. When drilling cast iron and other brittle metals, the supporting plate prevents the drill, when it breaks through, from flaking out rifts in the work around the hole. In most drill jigs, the leaf serves as the supporting plate, and is provided with a clearance hole directly under each bushing for drilling "through holes". In some cases the clearance holes are in an equalizer bar, or in the point of a clamping screw. Even with all these provisions, the holes drilled in the work must be "burred" after drilling. It is usually necessary to burr all the holes on both sides of the work. Burring is done by countersinking the edges of the holes with a larger drill. Sometimes the drill burrs are ground off. A special tool may be used for precision burring.

Designing Jigs with Cam-hook Locks

An excellent example of such a jig is seen in Fig. 114. Cam-hook jigs are fast in operation because the cam handle is pivoted in the leaf. The leaf can be opened and closed by the cam handle, using one quick movement of the hand. In its locked position, as shown in the

Fig. 114—Channel jig that has a leaf provided with a cam-hook lock. These types of jigs are generally used for drilling holes in work which has previously been milled or die cast to gage sizes.



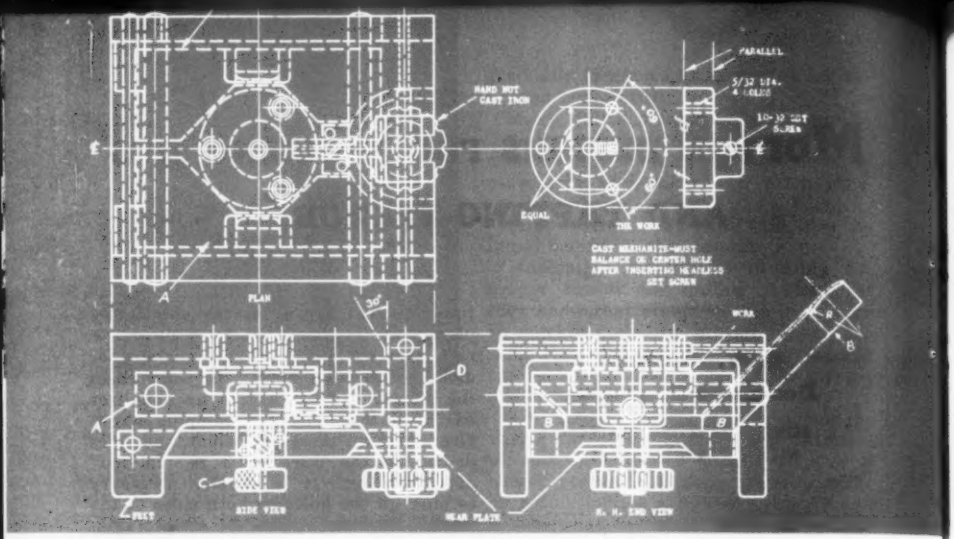


Fig. 115—Jig that automatically centralizes round work for drilling, when closing the leaf.

sketch, the floors of the leaf and jig body are parallel. This means that these jigs will take only that class of work which has been previously machined to gage sizes. The work, at the clamping points, should not exceed variation limits of more than plus or minus 0.003".

Work can be drilled and reamed from four sides—even through the leaf if all the pin bearings are provided with hardened and ground wear bushings and side washers. The work shown in the sketch is placed in the jig when the tool is turned "channel up". The leaf is then closed by a hand on the cam-handle and locked firmly by squeezing the handles together while turning the tool over on its feet for drilling.

Care should be used to provide spaces of ⅝" or more under the handles as clearance for fingers when picking up the jig. Point *A*, locking point, and dimension *B*, which is the clamping thickness of the work, should both be specified. These jigs are usually made for small work. The jig body is machined from a solid block of machinery steel. The leaf is also of machinery steel, machine finished, pack hardened and ground. The camhooks are made from tool steel forgings and several sizes of forged blanks are carried in stock. The jig body can be pack case hardened and, if warped, can then be straightened in a bench vise. The faces of all feet are surface ground. This "lines them up" in parallel planes on opposite sides of the jig.

Automatic Centralizer for Holding Round Work

The work sketched in Fig. 115 must balance on its center hole after drilling five holes and assembling a screw. The work is a rough casting with a milled face and, in order to balance properly, its group of holes must be positioned symmetrically within the piece. A drill jig that will centralize the work over the bushings is, therefore, necessary. If centralization can be accomplished automatically it obviously saves time in loading the jig and increases the hourly output. The jig body can be machined from a rough forged steel channel, from a cast iron channel, or from a block of machinery steel. The latter is preferable. Only the important working surfaces of the jig are machine finished. The leaf is made of cold rolled steel.

To load, the jig is first placed "feet up" on the drill press table; then the operator sets the finished surface of the work on a three-point bearing. The bearings are the shouldered heads on the drill bushings. A pair of centralizing V-jaws *A* are located with one jaw on each side of the work. The leaf carries two positively attached angular lugs *B*,

which when closing the leaf, contact 45° angles cut at the central sides of the jaws. While continuing to close the leaf, by tightening the hand nut, the jaws are forced toward one another equally and clamp the work centrally on both sides of the longitudinal center line of the jig. Since the drill bushings are also positioned equally each side of the center line, the work becomes centrally located in respect to the drill bushings. The jig is then turned over on its feet ready for drilling operations.

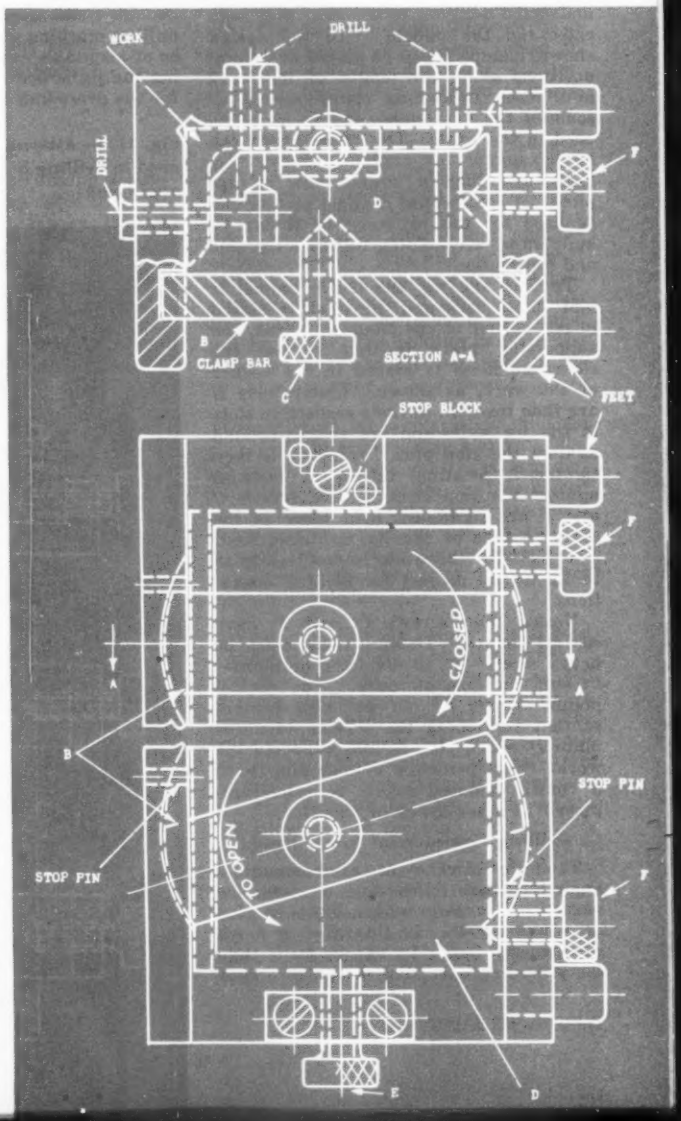
Attention is now directed to a precautionary feature that must be considered when designing centralizing or other sliding jaws, especially when drilling Meehanite, cast iron, or other similar materials that produce grit and dust. Centralizing jaws *A* are located away from the jig floor and slide on two parallel rods. If we attempt to design a jig with the jaws *riding* on the jig floor, small particles of grit and chips will crowd under the jaws and finally choke their free action. To foresee and to avoid such difficulties is an important part of successful tool engineering.

Draw-bolt *D* is designed wide enough to include a clearance hole for the drill to pass through when entering the bushing for drilling the 10-32 tapped hole. The jig is placed on its rear end for drilling this hole. Observe the proportional size of this tool when compared with the work: not ⅛" is wasted anywhere.

Jig for Drilling Angle Irons

To design a practical self-contained jig that can be rapidly loaded and unloaded, and for drilling holes in both legs of angle irons is not easy. To design a

Fig. 116—Channel jig and clamps for holding angle irons while drilling holes through legs.



good drill jig for an angle iron is quite difficult. Especially is this so if the sections are extremely long and wall thicknesses vary, or the legs are of unequal length, as shown in Fig. 116. This jig has a design feature in the clamp bars *B*, that can be incorporated in many other types of long channel jigs for clamping unequal thicknesses of work.

When drilling long sections of angles, the pieces are not always straight; this is another difficulty that may cause the distracted designer to try and "play both ends and the middle"! In the design shown, clamps *B* can be placed at several positions along the length of the work and, when tightening clamp screws *C*, some of the unevenness can be straightened in the work. The screw heads can be hexagonal for clamping heavy sections, and then a wrench can be applied. A commercial channel section can be used for the jig body, or it can be built up by arc-welding together the side and top plates.

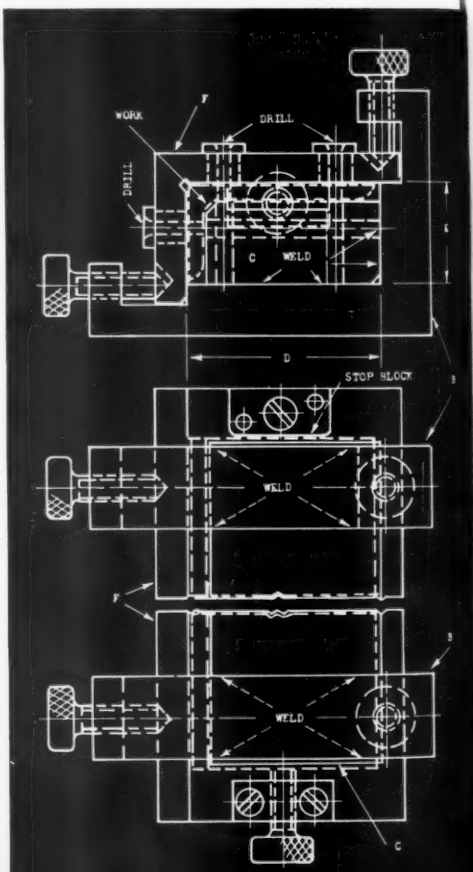
To load the jig, the body channel is laid on its back and the work is placed in one corner of the channel. Next, the supporting plate *D* that carries the clearance holes is placed in the corner of the work, as shown. Clamp bars *B* are then inserted in their respective slots in the jig walls and are swung around against the stop pins. Screw *E* is then tightened, locating the work endwise against the stop block. Next, screws *C* and *F* are tightened, with those at the extreme ends of the jig tightened first. The jig with the work is now ready to be turned on its feet for drilling operations.

Notice that screws *C* and *F* have conical points. These screws must be heavy sizes—½" in diameter or more—to suit the size of work. The conical points engage in "off-set" spot centers so that tightening the screws advances plate *D* which clamps and supports the work. This principle of clamping with a conical pointed screw is often employed in other types of jigs.

Drilling Commercial Angle Irons

The leg thicknesses of commercial angle irons are rolled close to sizes; the variation is usually within limits of plus or minus 0.003". In this case, a much cheaper and faster jig can be made than the preceding one. The design of one of these jigs is given in Fig. 117. Angular clamps *B*, made of machinery steel, are welded at the ends of support plate *C*, and at several other places along its entire length. Dimensions *D* and *E*, in the clamps, are made about ⅛" greater than the lengths of the legs on the work. The size of support plate *C* provides about 0.005" clearance for the legs between *C* and *F*. Care is used to have these dimensions exactly alike in all the different clamps; this is easily accomplished by milling the notches in *B* after clamping the pieces all together in a milling machine vise. Body angle *F* can be of a suitable commercial angle. Loading the jig is done similarly as described for the preceding tool.

Fig. 117 — Alternative design for a jig used in drilling holes through the legs of angle irons.



QUANTITY PRODUCTION TECHNIQUE APPLIED TO MARINE ENGINES

Assembling the Sixteen Ton Crank Shaft for the Liberty Ship Engine at Joshua Hendy Iron Works

SETTING up a smooth-running assembly operation in every department of the Joshua Hendy Iron Works, largest manufacturers of marine engines in the United States, to match the production pace demanded by today's shipbuilding program has been a key to the success of this company from the start. Reflecting the overall picture is the job being done in the crank-shaft-assembly department.

The Liberty ship engine, a 2500 hp triple-expansion reciprocating marine steam engine, known by the U. S. Maritime Commission as the EC-2, is a giant two-story power plant weighing 137 tons. Its crankshaft is 16 tons of that total weight. Engines of this class had never before been mass-produced in the assembly-line manner. This has meant that every department participating in its construction has required special planning to gear its operations to the whole mass-production method.

Following the assembling of one shaft will give a clear idea of how Hendy developed a speedy and efficient technique for this complex operation. The parts used in the shafts are placed in a stock pile adjacent to the shaft-assembling department. These parts are crank pins, journal pins, thrust shafts and webs. Six webs, each weighing 1800 pounds, are used in one shaft. These are moved to the heating tanks. Special clamping devices have been developed at Hendy for handling the webs, which are lifted and moved into the tanks in sets of two. A ten-ton overhead crane does all handling and assembling, lifting and placing. The heating tanks filled with a special heat-resistant oil are raised to 550 degrees F. and the webs are immersed in the oil for a period of three hours.

While the webs are being heated, journal pins, crank pins and thrust shaft are placed in position on the shrinking stand and height blocks. Even the shrinking stand is Hendy-built and developed. Journal pins and thrust shaft are held by the shrinking stand in alignment to an average of .005-inch tolerance. Allowable tolerance before finish turning is .010. The holding bases of the stand are keyed to the bed plate to assure this accuracy of alignment.

Crank pins are completely finished when brought to shrinking stands. Journal pins and thrust shaft are semi-finished to a .050 tolerance, to be finished in the lathe, following shaft assembly. One secret of successful web assembly is to have the webs in balanced relationship, despite the fact that they are not absolutely parallel.

When the heating process has been completed the well-coordinated crew of men who have assembled more than 400 of these shafts, move into action like a perfectly trained football team. The crane hoists a single web and carries it to the shrinking stand. The men stand by and as the web is brought opposite the first journal end, two men with a bar slide it onto the pin . . . a jack is placed under the end of the web, set at the approximate height which will give it the exact 120-degree angle in relationship to the other webs. The crank pin is then lifted and brought into position . . . again the men slide it into position.

Then the crane returns for the second web . . . this is brought into position as before. The stands on the shrinking stand move longitudinally to permit entrance of the web. As soon as it is slid onto the crank pin, the next journal pin is slid into the other end of the web and the first pair are then in place. Height blocks are brought over and placed under the crank pin to assure exact position and the jack is removed.

The same operation is then followed with each of the two remaining sets of webs. A seven-minute average of time is taken for the assembly of each set of webs. Shrinking occurs within thirty minutes after the web is put in place. The now assembled shaft is left to cool for twelve hours.

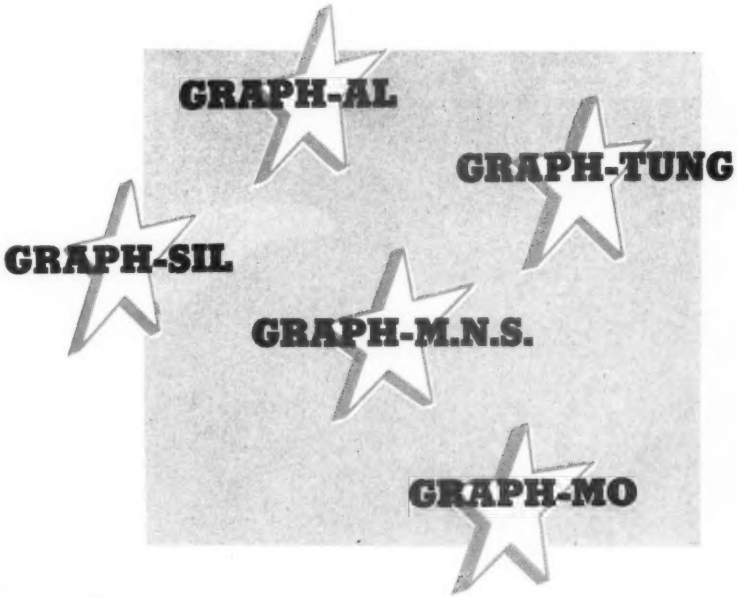
Webs are placed on the low-pressure section of the shaft in one operation and on the medium and high-pressure section in a second operation. Next dowel holes are drilled. An example of a Hendy principle of machine shop operation is witnessed in this next operation. Instead of moving the shaft to a power drill for the boring of the dowel holes, a special drill has been developed, a portable line reamer, which bores the dowel holes in position on the shaft. There are two inside and two outside dowels on each set of webs, and the webs are thus drilled in sets of two. Following this the webs are tapped for Allen screws. In assembling an EC-2 shaft, eight operations are necessary for the drilling of dowel holes. This has been cut to three operations in the drilling of dowel holes for the lighter convoy-vessel engines now being built.

Next operation is the cutting of the keyways for eccentrics. A portable keyway miller, another Hendy development, is placed on the shaft as an improvement on the old method of moving the shaft to the miller.

Following the cutting of the keyways, the shaft now in two major parts is brought together on a stand. A portable line reamer is used to finish the flange reaming. This portable line reamer is another of the Hendy improvements in quick assembly of shafts.

When the flanges are bolted together, the jacks installed between the webs to hold them in true alignment, the entire shaft is moved to the finishing department. Counterweights are placed in the webs and the shaft is given its finish lathe work.

Web being placed in position. Note jack about to be placed under end. This holds web at proper angle during shrinking process.



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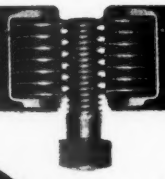

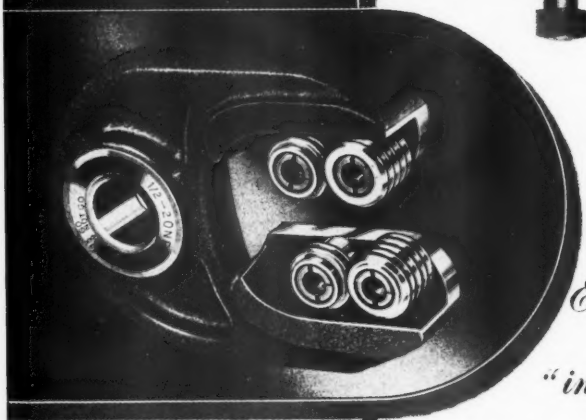

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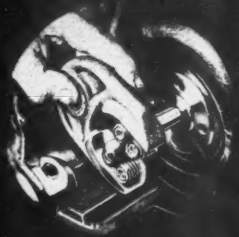

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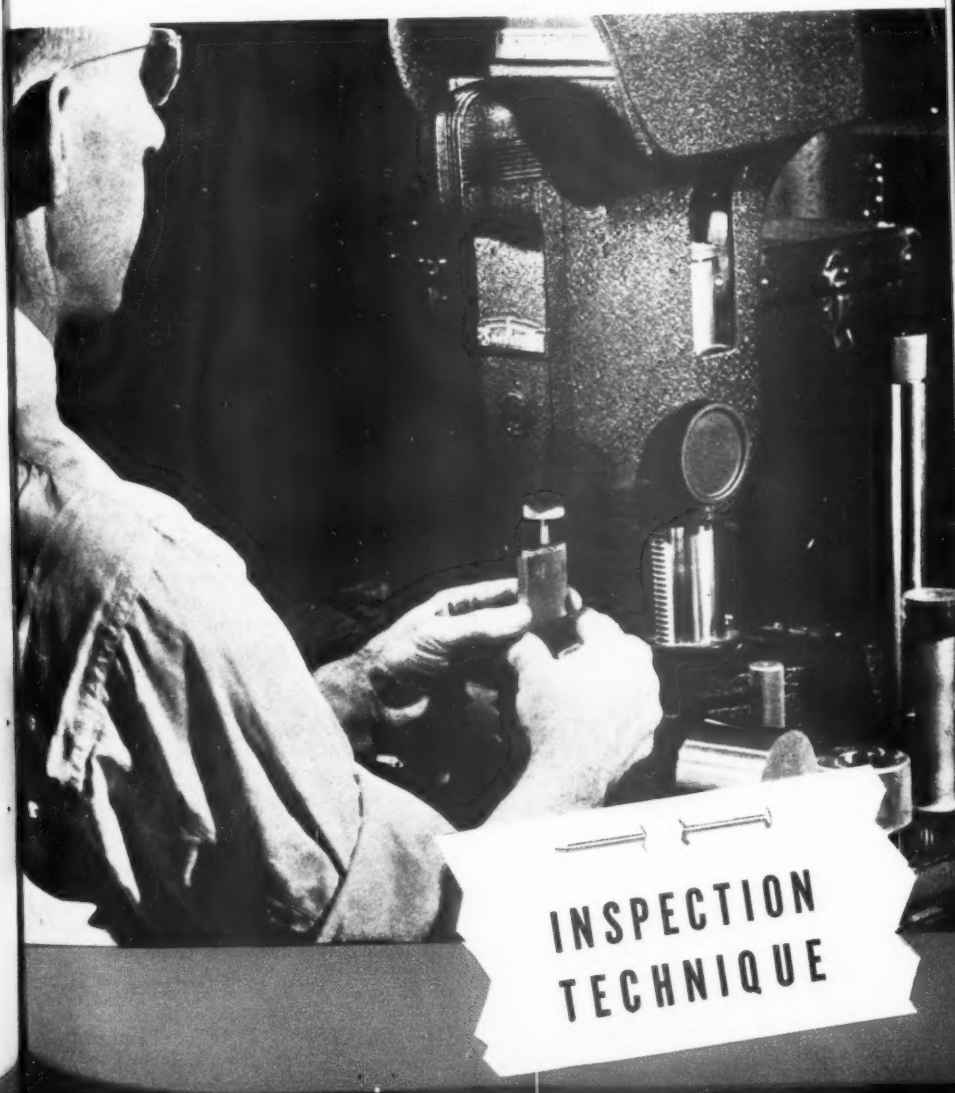
TRAINING *for Victory*

EDITORS: DON E. ROOT CHARLES H. HAYNES



INSPECTION TECHNIQUE

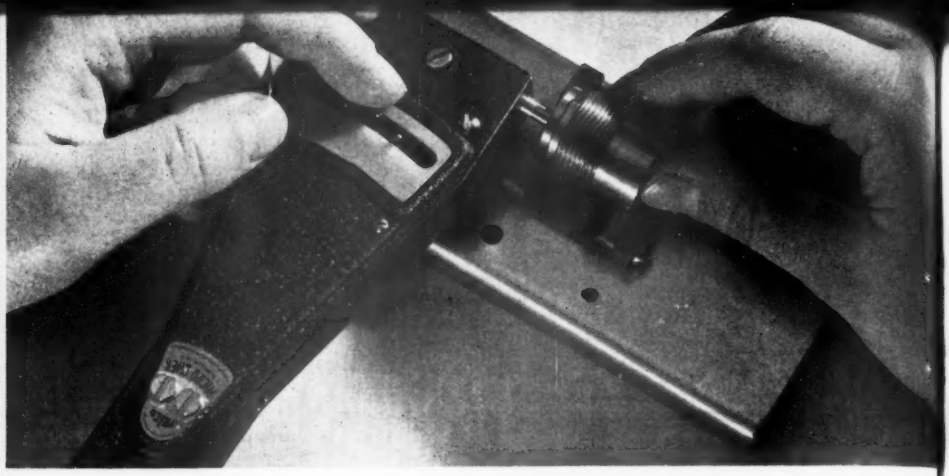
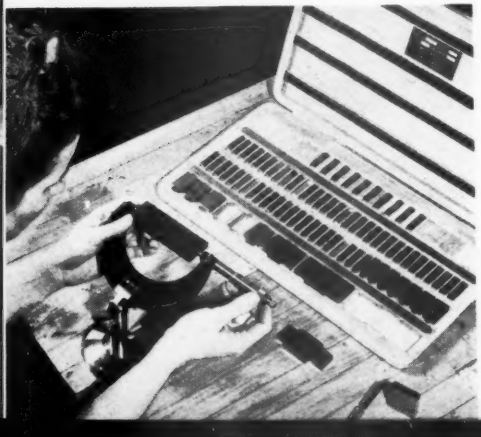


Fig. 1—Micro-chek gage designed for use with dial or as shown for gaging by blind inspectors

THE success and low cost of mass production in essential war industries can be directly traced to America's perfected system of interchangeable parts manufacture and to tolerance control. Without carefully prescribed precision manufacturing procedures, the rapid assembly of integral parts of complicated mechanisms would be impossible. As specified tolerance for precision manufacturing become more severe, parts assembly rates increase and the service life of the finished products is lengthened.

Comparatively, it was but a few years ago that a tolerance of one-half thousandth of an inch presented a real problem for the average production plant. Today tolerance specifications in tenths of thousandths are regular procedure and the producer of airplane parts talks almost entirely in micro-inches, millionths of an inch.

Fig. 2—Complete set of 81 precision gage blocks.



The completely equipped inspection department usually controls the inspection of all tools, dies, jigs and fixtures as well as the machines used in production. In turn they are fully responsible for the approval or rejection of each finished piece. Their cooperation with the design, engineering, tooling and production departments can help considerably in having fewer rejects and lower over all costs.

The design or engineering department will frequently ask for close tolerances on an area that fits into or wears against nothing. While the inspection department must exist as a separate division, cooperation in this respect will avoid manufacturing procedures and gaging operations totally unnecessary. It is sometimes well to form a committee made up of heads of designing, engineering, production and inspection departments to determine the required tolerances on all surfaces and sizes.

The old method of negative inspection, whereby a piece either met the necessary blueprint specifications or was rejected, has been substituted by a new inspection technique known as tolerance control. In this way it is possible to find the cause of the specific error when a rejection is made. It may result from poor

tool planning, negligence on the part of an employee or insufficient information given by a higher authority. This, of course, means that the modern inspector should be equally familiar with special tooling, machining operations and employee psychology.

Tolerance Control

In the large production plant, inspection takes on added importance as a major department or division and not only are they responsible for the work delivered to the customer but are equally responsible for the materials and supplies purchased. This means that the various raw materials must meet the full specifications detailed on their original purchase order. This makes it possible to reject materials that are unsatisfactory before any fabricating operations have taken place.

Today when thousands of prime contractors are subcontracting an important amount of their work, it is essential that this material be checked before it is made a part of a subassembly or finished product, for which the prime contractor is liable. A good practice for the subcontractor is to submit samples of the first run to Inspection or Quality Control before he completes the entire order. This practice may save considerable time and eliminate work spoilage. Purchases such as raw materials and parts are checked for physical properties, hardness, dimensions and in frequent cases, surface finish.

Fig. 4—Measuring pistons on special electric gage.

While close inspection of this type may result in many rejections and criticism on the part of suppliers, it is apparent that much time-consuming work is avoided by stopping the material at this point.

Special Tool Requirements

Special tooling is the foundation for producing interchangeable parts. Jigs, fixtures, dies and molds, gages and special tools that are not in perfect condition before production begins cannot produce perfect parts. These tools should be inspected, not only on their arrival from the contract shop or tool room, but should also be checked at regular intervals. In this way tooling errors can be corrected before the piece part has

Fig. 3—Tool setting gage adjusting tool on boring bar.

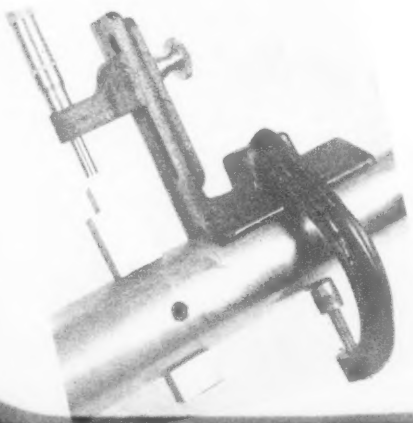


Fig. 5 Shadow gage used as final inspection height gage.

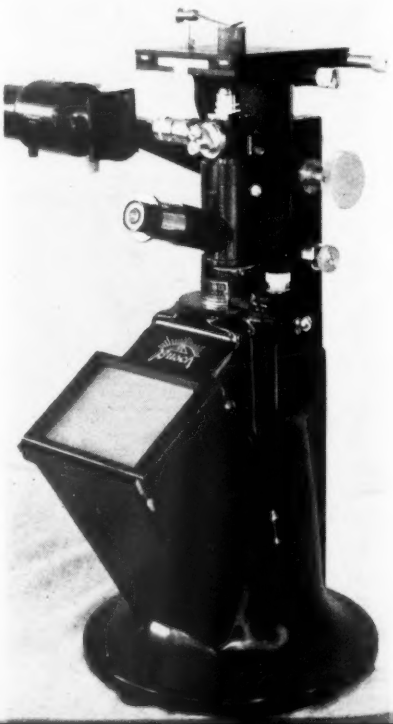
reached final inspection. In every case, however, the inspection department is fully responsible for the tooling used. They must guarantee it's in good shape before it is passed along to production. Inspectors in this work should be completely familiar with tool and die making.

In many plants, a record card is kept for each tool in the plant, data being entered on it giving the number of pieces produced with the tool, the hours of operation, the machine on which it is used and data on each periodic check. Some jigs and fixtures, and almost every die should first produce sample parts that are sent to the central inspection room for approval and each is then kept as a master piece. The inspection of tools also includes the approval of all gages and measuring instruments used. All inspection gages on the inspection line are dated and released for use, but this does not release the tool laboratories from continuing responsibility. Constant dimensional control is particularly important because some gages are used so frequently that it is necessary to check them every few hours. As an example, on the final inspection of a precision part with a tolerance of plus or minus .00008, the gage is checked every 300 to 350 pieces. In an average eight-hour shift, the inspector would gage 900 to 1000 pieces. This means that the gage is checked three times in one shift. On the other hand, some gages, particularly those used following a machining operation, need to be inspected only one or twice a week.

Process Inspection

When the piece part has many machining operations, it is well to discover any defects as soon as possible. For this reason a regular inspection should take place at the machine following each op-

Fig. 6 Optical comparator used primarily in tool inspection.



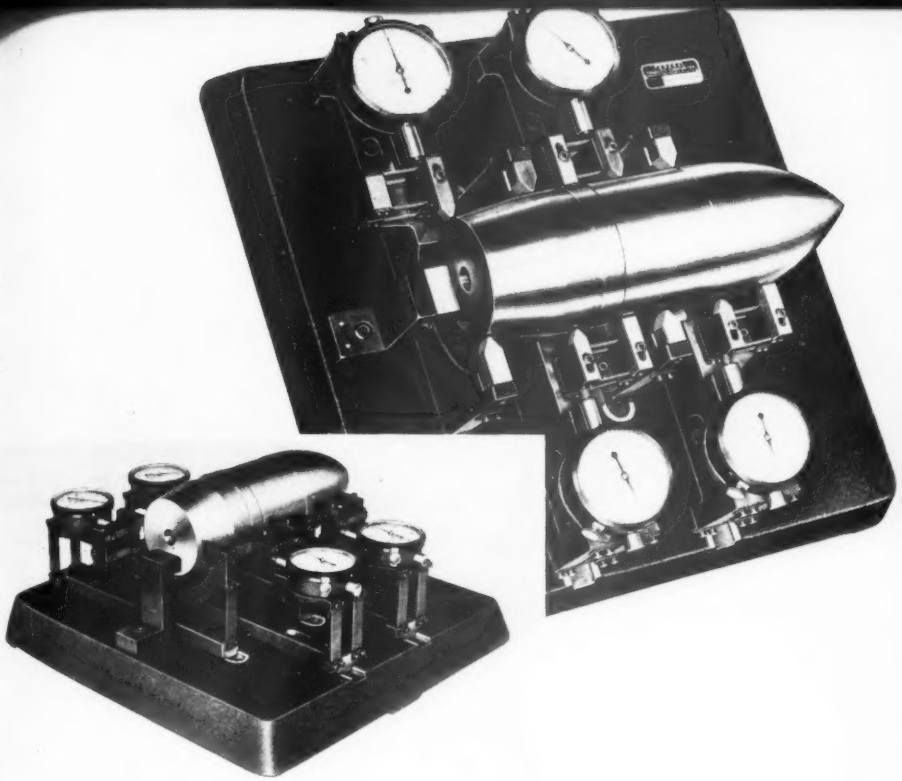


Fig. 7—A special multiple gage used for inspection of shells.

eration. Frequently when an error is found at this time, a correction can be made which would be impossible as subsequent operations took place. An equal balance must be found between the process inspection and final inspection. There is an important place for both. Sometimes it is only necessary for a roving inspector to check the first few pieces after a machine has been set up. On more precise work, every piece is checked by the operator.

Master Inspection

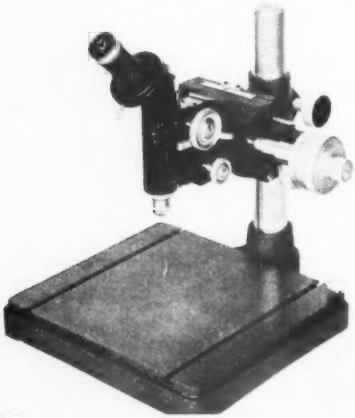
In addition to a centralized inspection department, there are frequently smaller inspection laboratories conveniently located throughout the plant. The majority of gages are set in these departments and in turn the gages used in the tool setting departments are set by the central department which rounds out a perfect cycle of tolerance control. In the master gagelaboratory, the atmospheric conditions should be consistent. The standard temperature in most air conditioned laboratories is 68° F or 20° C. However, when gages are going to be used at higher temperatures or lower temperatures, it is well to have them set under equal conditions. One large airplane parts manufacturer whose plant temperatures range from 80° to 82° find that gages checked at 72° give a much more satisfactory performance.

A certain amount of wear is to be expected on all gages, even under most ideal conditions. With certain types of fixed gages, particularly plug, ring, snap and similar perishable gages, it is advisable to have a film of oil between the piece and the gaging surface. It is interesting to note that the natural oil

Fig. 8—An air gage designed for measuring internal dimensions.

from the operator's hair, if wiped on the piece or gage surface, will appreciably reduce wear of the gage. Usually perishable gages are not scrapped, even after being excessively worn. They are ground an additional .002 of an inch under size and then hard chrome plate is applied. With this process, it is possible to strip and replate a gage three or four times. More than four times is seldom desirable because the stripping process will roughen the original surface and the plated surface will reflect the irregularities. Roughness on the surface of the gage will cause it to wear more rapidly and consequently all new gages should be lapped with a surface variance of four to six micro inches. This can be done with a 500 grit lapping wheel.

Fig. 9—Typical toolmaker's microscope.

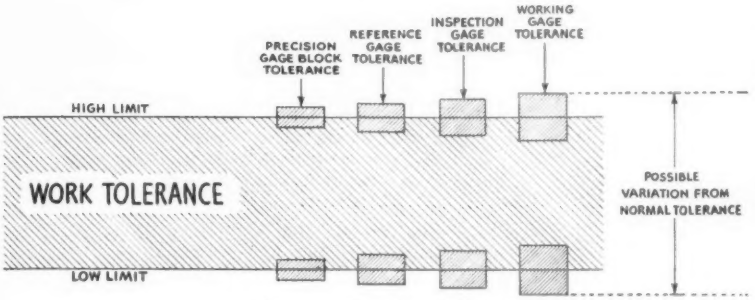


Inspector Qualifications

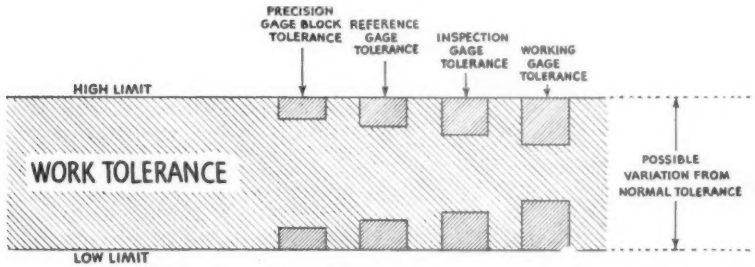
The inspection department should be headed up by an executive type of individual with the ability to guide the work not only of his own men, but from a cooperative standpoint those in other departments. Inasmuch as this requires supervision of tooling and production, it requires that he have experience in both activities.

The size of the inspection department will be determined by the quality of the finished products. A manufacturer of precision parts requires process and final inspectors. With a manufacturer of pieces that have generous tolerances, an occasional spot checking of the finished product is all that is necessary. It would be, therefore, impractical to set up a department that would suffice for every industry. For the larger plant, however, a chief inspector, his assistants, foremen and supervisors, and their inspectors make up this department. It is also found advisable in some cases to have authorities on tooling, engineering and production for consultation.

Tolerances — Bilateral and Unilateral



Tolerances as allocated by the bilateral system.



Tolerances as allocated by the unilateral system which is used on all United States Government ordnance work and on some commercial work.

THERE is no such thing as an exact dimension. A dimension is only approximate within specified limits or tolerance.

By the same reasoning, there is no such thing as an exact tolerance, for a tolerance, like a dimension, is a measurable extent or magnitude. Consequently, it is necessary to conceive the idea of tolerances on tolerances for each step in transferring a measurement from precision gage blocks through the reference gage, the inspection gage and the work gage to the work part itself. The manner of locating these tolerances has been controversial for a long time.

A bilateral tolerance is that wherein the limits, both high and low, bisect gage tolerances zones.

The unilateral tolerance is that wherein the limits entirely encompass all gage tolerances; that is all high limit gage tolerances negative and all low limit gage tolerances positive.

The bilateral system has been in use in this country for a long time and is probably adhered to at present for the majority of general commercial work. Ordnance engineers contend that the unilateral system is more scientific than the bilateral system and more effect in the production of precision work.

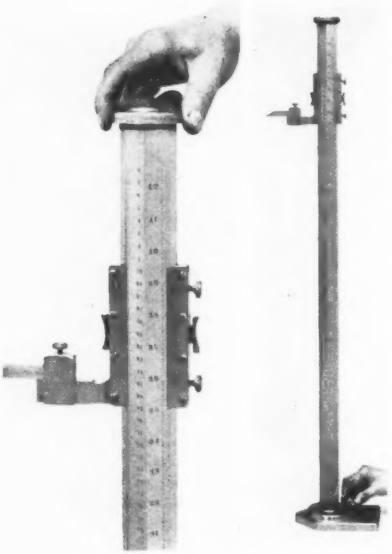


Fig. 10—Height Gage for tool inspection

Someone once said that any man or woman with average intelligence and even temperment would make a good inspector. While all of these things are necessary, it is equally important that he must have good judgment, the ability and willingness to follow instructions and above all a basic ability known as perception.

Experience is another important factor. Every inspection department has learned that experienced men will reject more pieces than new workers, which proves beyond question that experience is an important factor. Some inspectors say it is necessary to have stereoscoptic vision.

Human Errors

Every gaging device is designed to eliminate as much as possible the important possibility of human error. Each inspector must gain a certain "touch". It is frequently possible for a dozen people to gage the same piece and each have a different measurement. The accuracy of the machine or tool is also subject to many variables. A worn gage can frequently give different measurements to the same piece. Physical skills such as muscular coordination, accurate vision and sensitivity of touch make for accuracy. Day dreaming and distractions are costly. The pressure of work, the gradual upward shift of the inspector's standards of quality and fluctuations in the type of material have their influence upon the quality and the efficiency of the inspection department. In general, the greater the extent to which human controls enter into processing and inspection, the greater is the likelihood of error.

We are indebted to Federal Products Corp., Bartelt Mfg. Co., Geo. Scherr Co., Sheffield Corp., and others for illustration and textual data for this special section.

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INDUSTRIAL TEMPERATURE MEASUREMENT AND CONTROL

By Eric N. Simons

UNTIL manufacturers started to produce pyrometers for industrial use, there was a tendency to regard these instruments as delicate laboratory tools. The enormous development of the science of heat treating metals, as well as other kindred advances necessitating close control of temperature, made it imperative to produce pyrometers capable of being used in modern production. This meant that they had to be sufficiently sensitive for laboratory or research work, and also sturdy enough to withstand the severe conditions of everyday industrial use.

One discovery that helped to make this possible was a patented moving coil system which is described later.

Concentrated effort in the last 30 years has resulted in improvements in design, method of manufacture, and technique of operation of British temperature measuring equipment. Rigid testing is a most important feature of the manufacturing program, and is applied not only to each complete equipment, but to all raw materials and each individual component.

A detailed technical record is opened by one firm for every instrument made, on which is entered all the later history of repairs, if any. Improvement or development is made in the light of extended practical knowledge of the desired service.

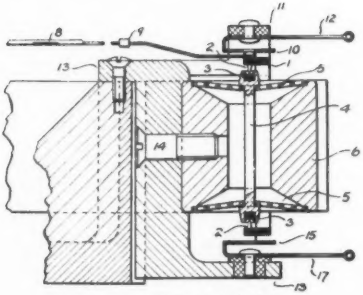
Instruments are not mass produced, as a rule, each outfit being separately calibrated and tested under conditions approaching closely to the actual conditions of use.

In most industrial pyrometers the current recording instrument includes a coil, turning in the field of a permanent magnet, and carried on one or two very finely pointed pivots. These work in conical jewels, on principles broadly resembling those used in an ammeter or voltmeter.

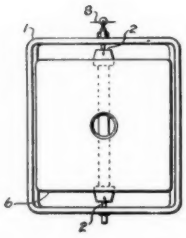
The problem of preserving these fine points under rough-handling conditions often unavoidable in industrial service has not been easily solved. Although the weight of the moving system is kept extremely low, the fineness of the pivot points represents a considerable steady load in tons per sq. inch. This load is considerably increased by any vibration or jar, and a succession of such occurrences damages the points.

The patented system already mentioned connects all the jewels together, and then the entire system, comprising coil, pivots, and jewels, is carried on delicate spring supports. Thus, pivots and jewels are unable to part company or strike against each other, all vibrations, both axial and transverse, being adequately cushioned.

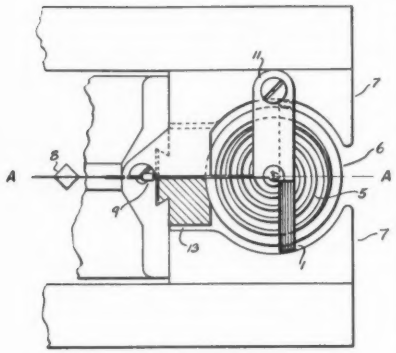
Pyrometers containing a permanent magnet have to be magnetically shielded by the base and cover. The instruments should be calibrated with a certain distribution of the magnetic force of the magnet, and to retain this permanency of indication, distribution must remain unaltered. In some British instruments of the circular type, in addition to a cast iron base, a pressed cover of mild steel is used. In order that the shielding may be effective, the cover is given a reasonable degree of thickness, usually



SECTION ON A-A.



ELEVATION OF COIL & CORE UNIT.



PART SECTIONAL PLAN.

Diagrams show details of the patent system employed to connect all jewels together. 1. coil. 2. inturned pivots. 3. conical jewels. 4. axis. 5. light springs. 6. cylindrical iron core. 7. magnet. 8. light pointer. 9. small sliding weight. 10. central spring. 11. frame. 12. arm, controlling zero. 13. rigid frame. 14. screw holding core. 15. ligament. 16. insulated arm.

one-sixteenth of an inch. This pressing is not too easy to make, but the difficulty was overcome by very careful annealing at various stages of the pressing process.

The method of driving the continuous chart of a recorder has presented a serious problem to designers. In British instruments one method adopted has been to use friction rollers only, engaging at the center of the chart.

This method was unsuccessful when tried with a single friction drive, but complete success was secured with two friction drives. Before it reaches the recording position, the chart passes through a "permissive" drive governing the time rate of the chart. After it has passed the recording position, the chart passes under a glass plate and is there subject to a slightly over-driven friction pull of lighter pressure, keeping the chart taut and making it run true.

Many British electrical controllers operate on the potentiometric principle, but when employed with electrical resistance thermometers operate as Wheatstone Bridges. A galvanometer forms the sensitive detecting unit, the "balanced" or null position of the pointer being adjusted by a rheostat to correspond with the temperature at which control is desired. Any deviation from this temperature results in the tilting of a mercury switch, thus breaking or making the electric supply or actuating electrically-operated valves or heavy current auxiliary contactors controlling the supply of heat.

Instruments are made to control temperature from 200° C to 2000° C. When using thermocouples, the manufacturers apply an automatic cold junction compensator fitted in the instrument, and a broken thermocouple device is frequently incorporated. This switches off the furnace if the thermocouple circuit is broken, thus preventing wholesale spoilage should any defect arise in the control or supply mechanism.

SPHERICAL TRIGONOMETRY

SIMPLIFIED

By E. H. Needham

WITH the American factory worker intent on winning this war, there is only one way for him to approach his job, and that is to do things the quickest and the finest as he knows how. The spherical trigonometry chart presented in Figs. 4 and 5, with its simplicity should prove of great value to those who use it and help, even in a small way, to speed up the production so vital to our cause.

Spherical trigonometry deals with the measurement of triangles that are on the surface of spheres. The sides of a spherical triangle curve across the surface of the sphere, and unlike a plane triangle, the angles at the three corners of the triangle total 180 degrees or more.

The heavy black lines A, B, C, of the chart represent a right spherical triangle; the lines B, C, S, represent an oblique spherical triangle; the lines J, K, L, represent the radii of the sphere as they extend from the center of the sphere to the corners of a spherical triangle; the plane triangles indicated by dotted lines, result from this combination of radii, and it is the relation of the angles of these plane triangles that enables us to calculate the position, dimensions, and angles of the spherical triangle.

It will be remembered that a circle, likewise a sphere, has 360 degrees; each degree has 60 minutes; each minute has 60 seconds. An angle is related to its triangle by six different proportions; these are called the functions of the angle; they are: the sine, cosine, tangent, cotangent, secant, and cosecant, abbreviated they are: sin, cos, tan, cot, sec, and csc.

A natural trigonometric function table contains these fractional proportions or functions expressed as decimals; the numbers for the sine, cosine, etc., are arranged in columns under each degree of angle; the numbers for the minutes of the angle are arranged from 1 to 60 from top to bottom, from 0 to 45 degrees, and from 45 to 90 degrees, from bottom to top each page; for angles 0 to 45 degrees we use the functions listed at the top of the page; for angles 45 to 90 degrees we use the functions listed at the bottom of the page.

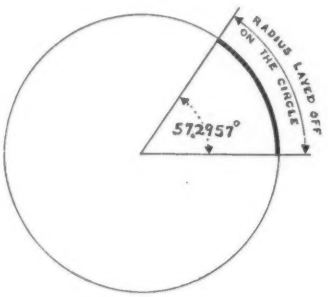


Fig. 1

Converting Functional Values to Degrees, Minutes, Seconds (Angles 0 to 45 Degrees).

Suppose we have the number .694900 as the sine of an angle, we wish to find the degrees, minutes, seconds. By comparing our number with the numbers in the columns of sines in a natural function table, we see that it is between the num-

ber .694868 for 44 degrees, 1 minute and .695077 for 44 degrees, 2 minutes; we find the seconds by the following method.

Obtain (by subtraction) the difference for one minute, between the number

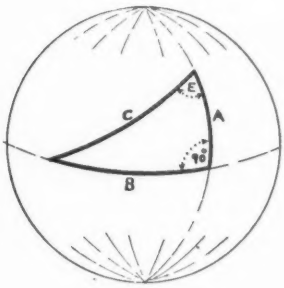


Fig. 2

above and the number below, for example .695077 − .694868 = .000209.

Then obtain (by subtraction) the difference between the number of the angle and the number above it, for example, .694900 − .694868 = .000032.

Multiply this last difference by 60 and then divide by the number that was obtained for one minute, for example, .000032 × 60 = .001920; then dividing, we have .001920 = 9 seconds, plus; the

.000209

angle then is 44 degrees, 1 minute, 9 seconds, plus.

Converting Functional Values to Degrees, Minutes, Seconds (Angles 45 to 90 Degrees).

Suppose that the given number .694900 is the cosine of an angle, instead of the sine, we will find that it is between the same numbers .695077 and .694868 that we found for the sine of the angle. Using the functions listed below we see that .695077 is the cosine of 45 degrees, 58 minutes, and 694858 is the cosine of 45 degrees, 59 minutes, therefore our number corresponds to the cosine of an angle of 45 degrees, 58 minutes and several seconds. We find the seconds by the method explained above, with one exception; we obtain the difference for the seconds between the number of the angle and the number below it for example, .695077 − .694900 = .000177. As before, we multiply this difference by 60 and then divide by the number for the difference for one minute, for example, .000177 × 60 = .0010620 and in this case the difference for one minute is the same as we obtained for the sine in the explanation above, then dividing, we have .0010620 = 50 seconds, plus; the angle

.000209

then is 45 degrees, 58 minutes, and 50 seconds, plus.

Addition, Subtraction, or Division of Angles in Degrees.

In some calculations it is necessary to add two or more angle values; we set them in columns of degrees, minutes, seconds, and secure the total; then if the seconds total more than 60, we subtract 60 from the second and add 1 to the minutes; then if the minutes total more than 60, we subtract 60 and add 1 to the degrees, or subtract 120 and add 2 to the degrees, etc.; as shown, we have 116 degrees, 2 minutes, 18 seconds.

If we wish to subtract the value of one angle from another, we set the greater angle above the lesser angle subtracting, first, the seconds, next, the minutes and so on; if the seconds of the greater angle are less than those of the lesser angle, we deduct 1 from the minutes of the greater angle and add 60 to the seconds; likewise if the minutes of the greater angle are less than those of the lesser angle, we deduct 1 from the degrees of the greater angle and add 60 to the minutes, for example; 59 degrees, 55 minutes, 10 seconds, subtracted from 85 degrees, 36 minutes, 32 seconds, gives us 25 degrees, 41 minutes, 22 seconds, as shown.

If we wish to secure one-half of the value of an angle, we divide the degrees, minutes, seconds, by 2; then if we have a remainder of ½ degree, we add this as 30 minutes to the answer obtained by dividing the minutes by 2; if we have a remainder of ½ minute from the division of the minutes, we add this as 30 seconds to the answer obtained by dividing the seconds by 2.

Converting Degrees, Minutes, Seconds, to Functional Values

Suppose that we wish to find the functional value, or the number corresponding to the sine of 5 degrees, 20 minutes, 15 seconds.

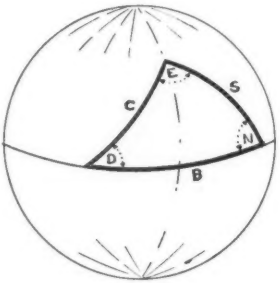


Fig. 3

In the columns of sines of a natural function table we find the sine of 5 degrees, 20 minutes is .092950 then the difference for one minute, we find by subtraction from the next higher number .093239 − .092950 = .000290.

We multiply this difference for one minute by the seconds and then divide by 60, for example, .000289 × 14 = .004046 then dividing we have .004046 = $\frac{}{60}$ .000067; is the sine value of 14 seconds, at the angle of 5 degrees, 20 minutes. This value for the seconds is added to, or subtracted from, the number for the degrees and minutes, depending upon the function.

For the Sine, Tangent, and Secant, the value for the seconds is added to the number for degrees, for example, .092950 + .000067 = .093017 as the sine of 5 degrees, 20 minutes, 14 seconds.

For the cosine, cotangent, and cosecant, the value for the value for the seconds is subtracted from the number for degrees and minutes.

This method holds true for any angle contained in the function table; for the purpose of illustration, we will find the tangent of 66 degrees, 2 minutes, 12 seconds. Now as this angle is greater than 45 degrees we will use the functions listed at the bottom of page 122, and looking in these columns of tangents, we see that our number will be 2.249558 for 66 degrees, 2 minutes; we must find the value for 12 seconds.

The difference for one minute is 2.251322 − 2.249558 = .001764 then this difference multiplied by the seconds is .001764 × 12 = .021168 and then dividing by 60 we have .021168 = $\frac{}{60}$ .000353 as the value of 12 seconds.

As our function is the tangent, we add

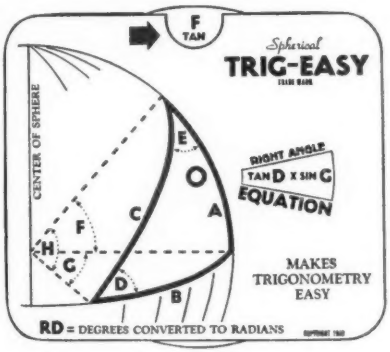


Fig. 4

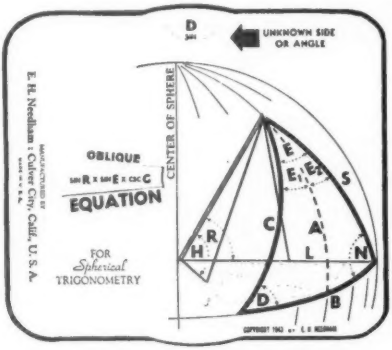


Fig. 5

to the numbers for the angle, 2.249558 + .000353 = 2.249911 as the tangent of our angle.

The measurement of the side of a spherical triangle is usually expressed in terms of degrees, minutes, seconds; each side is the arc of circle on the sphere, for example, the length of the line "C" of the chart, depends upon the value of the angle "H". Viewed in this manner, the radius of the sphere is regarded as unity or equal to 1.

For simplicity in calculating the side of a spherical triangle, as a dimension rather than an angle, several equations are included, that express the measurement of a side as proportional to the radius, and vice versa. These equations are based on the laws of circular measure and a brief explanation will be in order.

From Geometry, we know that the circumference of a circle is equal to 2 × 3.141592 × radius; that is, the radius of a circle can be layed off 2 × 3.141592 or 6.283184 times on the circumference. The value of the radius is then $\frac{1}{6.283184}$ part of the circumference. As the circle has 360 degrees, the radius layed off once, on the circumference will create an angle at the center of the circle as $\frac{1}{6.283184}$ of 360 or 57.2957 degrees; this is called, one radian, as shown by Fig. 1.

Now as the radius of the circle is related to the circumference as 1 is to 6.283184 then one degree of angle will be $\frac{1}{360}$ of 6.283184 or .017453; this is called .017453 radians.

If we know the value of an angle in degrees, we can convert this value into its equivalent in radians and vice versa; this gives us a means of calculating the relation of the sides of a spherical triangle to the radius of the sphere.

The equivalent in radians, of an angle is represented in the spherical equations by the symbol "rd"; the valuable conversion table printed below is for ready reference.

Fig. 6

CONVERSION TABLE

Deg.	Radians	Deg.	Radians	Deg.	Radians	Min.	Radians	Min.	Radians	Sec.	Radians	Sec.	Radians
1	.017453	31	.541052	61	1.064650	1	.000290	31	.009017	1	.000004	31	.000150
2	.034906	32	.558505	62	1.082104	2	.000581	32	.009308	2	.000009	32	.000155
3	.052359	33	.575958	63	1.099557	3	.000872	33	.009599	3	.000014	33	.000160
4	.069813	34	.593412	64	1.117010	4	.001163	34	.009890	4	.000019	34	.000164
5	.087266	35	.610865	65	1.134464	5	.001454	35	.010181	5	.000024	35	.000169
6	.104719	36	.628318	66	1.151917	6	.001745	36	.010472	6	.000029	36	.000174
7	.122173	37	.645771	67	1.169370	7	.002036	37	.010763	7	.000034	37	.000179
8	.139626	38	.663225	68	1.186824	8	.002327	38	.011053	8	.000038	38	.000184
9	.157079	39	.680678	69	1.204277	9	.002618	39	.011344	9	.000043	39	.000189
10	.174532	40	.698131	70	1.221730	10	.002908	40	.011635	10	.000048	40	.000193
11	.191986	41	.715585	71	1.239183	11	.003199	41	.011926	11	.000053	41	.000198
12	.209439	42	.733038	72	1.256637	12	.003490	42	.012217	12	.000058	42	.000203
13	.226892	43	.750491	73	1.274090	13	.003781	43	.012508	13	.000063	43	.000208
14	.244346	44	.767945	74	1.291543	14	.004072	44	.012799	14	.000067	44	.000213
15	.261799	45	.785398	75	1.308997	15	.004363	45	.013090	15	.000072	45	.000218
16	.279252	46	.802851	76	1.326450	16	.004654	46	.013381	16	.000077	46	.000223
17	.296706	47	.820304	77	1.343903	17	.004945	47	.013671	17	.000082	47	.000227
18	.314159	48	.837758	78	1.361356	18	.005236	48	.013962	18	.000087	48	.000232
19	.331612	49	.855211	79	1.378810	19	.005527	49	.014253	19	.000092	49	.000237
20	.349066	50	.872664	80	1.396263	20	.005817	50	.014544	20	.000097	50	.000242
21	.366519	51	.890117	81	1.413716	21	.006108	51	.014835	21	.000101	51	.000247
22	.383972	52	.907571	82	1.431170	22	.006399	52	.015126	22	.000106	52	.000252
23	.401425	53	.925024	83	1.448623	23	.006690	53	.015417	23	.000111	53	.000257
24	.418879	54	.942477	84	1.466076	24	.006981	54	.015708	24	.000116	54	.000261
25	.436332	55	.959931	85	1.483529	25	.007272	55	.015999	25	.000121	55	.000266
26	.453785	56	.977384	86	1.500983	26	.007563	56	.016289	26	.000126	56	.000271
27	.471239	57	.994837	87	1.518436	27	.007854	57	.016580	27	.000131	57	.000276
28	.488692	58	1.012291	88	1.535889	28	.008145	58	.016871	28	.000135	58	.000281
29	.506145	59	1.029744	89	1.553343	29	.008435	59	.017162	29	.000140	59	.000286
30	.523598	60	1.047197	90	1.570796	30	.008726	60	.017453	30	.000145	60	.000290

THE IMPORTANCE OF TOOL STEEL SCRAP CONSERVATION

THE increased demand for tool and special alloy steels for use in munitions and armaments and in the tools required to manufacture such munitions and armaments has caused an acute shortage in tungsten, molybdenum and cobalt. In normal times, when tungsten, molybdenum and cobalt are readily available in ores and alloys, the conservation and collection of tool steel scrap has not been carried out in the United States as in other industrial countries. However, all available tool steel scrap is now urgently needed as a secondary source of these alloys.

Because of this situation, salvage and collection of tool steel scrap containing these strategic alloying elements is being carried on by manufacturing concerns and scrap dealers who have not had experience with this type of scrap. This information sheet contains material which should prove helpful to those now participating for the first time in conserving and segregating this strategic material.

What is Tool Steel Scrap?

Tool steel scrap is the secondary source of tungsten, molybdenum and cobalt for the production of tool steels, special alloy steels and alloying materials. Tool steel scrap includes what is known to industry as high-speed steel scrap, but its meaning is broader in that it includes all alloy steel scrap materials with a tungsten content of one percent or more or a molybdenum content of one and one-half percent or more with or without cobalt. It appears on the market in the form of broken, obsolete and worn-out tools, machine shop millings and turnings and broken or obsolete industrial supplies and equipment.

Hundreds of articles are manufactured from tool steel. Some of the most common articles are as follows:

Augers, blanking and molding dies, bolt headers, boring tools, broaches, chisels, cutters, dental and medical instruments, drill rods, finishing tools, friction saws, gages, hack saws, high duty shafts, high speed drill bits, hot saws, lathe tools, metal dies, metal punches, milling tools, reamers, rivet sets, rock drills, saws for both cutting and slitting, shear blades and taps.

There are no standard specifications for the steels used in the above articles, and not all of them are made with tungsten, molybdenum and cobalt-bearing steels. However, many of them do contain appreciable amounts of these alloying elements.

What is the Spark Test?

If the alloy content of an article is not known, the most common method of identifying it, as to type of tool steel scrap, is the spark test. In this test both ends of the article are sparked on a 30 to 60 grain emery wheel traveling at a surface speed of from 7500 to 8000 feet per minute. The presence of different alloying elements in steel produce different sparks which enable a trained operator to identify the article as to type of tool steel scrap.

It should be remembered that the spark test does not provide an exact analysis of the steel, but it simply indicates the type and permits a quick check on the identity of the contained alloying element. Constant practice and experience are necessary to become an expert spark-tester. If it is necessary to determine exactly the amounts of the alloying elements in a piece of steel, the best method is to get a chemical analysis from the laboratory.

(Continued on Page 124)

(Continued from Page 123)

Some of the tool steel scrap consumers, the tool steel producers, have published charts showing the sparks produced by the different alloying elements and explaining the mechanics of the spark test in detail. These charts can be obtained from the tool steel producers or the Office of Price Administration.

Who buys tool steel scrap?

The major consumers of tool steel scrap are the producers of tool and high-speed steel for sale. These companies include:

Allegheny Ludlum Steel Corp., Dunkirk, N. Y.
Braeburn Alloy Steel Corp., Braeburn, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Chicago Heights, Ill.
Copperweld Steel Co., Warren, O.
Crucible Steel Co. of America, New York, N. Y.
Henry Disston & Sons, Inc., Tacony, Philadelphia, Pa.
Heppenstall Co., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel and Disc Div., New Castle, Ind.
Jessop Steel Co., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Simonds Saw and Steel Co., Lockport, N. Y.
The Midvale Co., Nicetown, Philadelphia, Pa.
Universal-Cyclops Steel Co., Bridgeville, Pa.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Some scrap dealers make a specialty of handling tool steel scrap. These dealers are known as tool steel scrap dealer-specialists. They are equipped to spark-test and in some cases, to make a chemical analysis of the scrap; and they are recognized by several consumers as being qualified to properly segregate and analyze tool steel scrap. Some of these dealer-specialists are as follows:

Metallurgical Products Company
35th and Moore Avenue
Philadelphia, Pennsylvania

Frankel Company, Inc.
1627 West Fort Street
Detroit, Michigan

I. Schumann and Company
2666 East 34th Street
Cleveland, Ohio

The M. N. Landay Company
1304 Clark Building
Pittsburgh, Pennsylvania

The Philip G. Smith Company
Outer Drive and Pennsylvania R. R.
Lincoln Park
Detroit, Michigan

Chicago Alloy Products Company
712 West Liberty Street
Chicago, Illinois

The above list of tool steel scrap dealer-specialists was furnished to OPA by the Institute of Scrap Iron and Steel, and may not include all tool steel scrap dealer-specialists.

Additional information

The foregoing general information is not intended to be complete, but covers only material on questions most frequently asked of OPA. Inquiries of a detailed nature relating to specific lots of scrap should be directed to consumers or dealer-specialists.

Late in April, the regional WPB's Available Inventory Department announced its "Reclaimable Materials Exchange"—a brand new clearing-house service designed to intercept factory rejects and remnants between production machines and scrap piles and get them back quicker into war production by the simple but oft-neglected expedient of offering them to other plants for re-working, turning down or otherwise utilizing them in their present fabricated or semi-fabricated states.

The immediate and pressing aim was to match up manufacturers having significant amounts of such usable rejects or remnants with other manufacturers who could use or re-work them, in lieu of hard-to-get prime mill stocks, in order to complete urgent war orders and forestall plant stoppages.

DRY FILM LUBRICATION

. . . PRODUCTION AID

John M. Lupton

ACHESON COLLOIDS CORPORATION

THE substance graphite which has an oily, slippery feel has long been recognized as an excellent solid lubricant. It is soft—softer in fact than talc, from which face powder is made. It resists high temperatures; consequently, it retains all its properties, especially its value as a lubricant, long after liquid lubricants have burned off. Nor are any of its physical properties changed by extremely low temperatures.

Graphite does not readily combine chemically with other elements; hence, the presence of other substances does not impair any of its physical properties. All graphites are not, however, alike by any means.

One form of graphite, sometimes known as "Plumbago" or "black lead," is a mineral found in a number of places throughout the world. For years this natural graphite has been available in powdered form for the lubrication of certain types of heavy equipment, but it is not suitable for the great majority of today's industrial machines.

Natural graphite frequently contains varying amounts of foreign matter which is definitely abrasive and therefore could be detrimental in many applications in which graphite is to serve as a lubricant or where purity is an important factor.

It wasn't until Dr. Edward Goodrich Acheson invented the process for making graphite in the electric furnace that a practically pure graphite became commercially available. The extremely high temperatures used in this process eliminate impurities and produce a commercial graphite far more uniform than it is possible to obtain in any other way.

Ordinary graphite, partly because of the particle size, cannot be held in suspension in water or in any of the oils commonly used for lubrication. It quickly settles out.

For the same reason, ordinary graphite might soon clog the lubricators, oil lines and oil grooves in most lubrication systems. The finest *powdered* graphite available today contains particles still too coarse for the lubrication of precision spindle bearings or other close tolerance elements designed to operate with very small mechanical clearance.

In other words, the lubricating value of this graphite powder cannot be utilized in numerous cases because its particles are too large. It is only when particle size is extremely small that the valuable physical properties of graphite can be fully utilized. A practical method of reducing particle size below the lower limit of mechanically ground powder is by the process of colloidalizing.

Colloidalizing graphite is a special process wherein each particle of powdered electric furnace graphite is subdivided into thousands of much smaller particles—small enough to readily pass through the microscopic pores of filter paper.

No one liquid carrier could possibly meet all the requirements for a carrier of colloidal graphite in the broad range of industrial applications. Consequently it is dispersed in numerous liquids such as distilled water, petroleum oil, castor oil, glycerine, naptha and mineral spirits. Any dispersion is possible simply by adding additional liquid.

In this way, any desired amount of graphite for a specific use can be proportioned by the amount the concentrated dispersion of known graphite content is diluted.

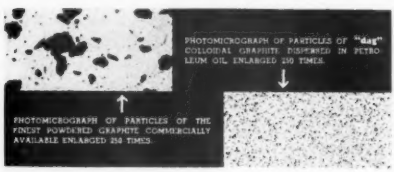
When added to lubricating oils, col-

loidal graphite particles readily become adsorbed on metal surfaces during operation. For all practical purposes, the graphite becomes a part of the surface metal giving the surface the properties possessed by graphite, especially its value as a lubricant, as long as it is present. It cannot be washed off. The only way it can be removed is by prolonged and severe abrasion. Although graphite becomes affixed to the metal by adsorption, there is no build-up on such graphited surfaces to measurably reduce the clearance between opposing parts. The most sensitive gage does not record any difference in dimensions of a mechanical element before and after its surfaces have been "graphoidized."

When colloidal graphite is present in the oil used for running-in engine and compressor cylinders, piston rings, bearings, reduction gearing and valves, the following results are obtained:

1. Smoother bearing and rubbing surfaces.
2. Less power lost from friction.
3. Lower operating temperatures.
4. Shorter running-in period required.
5. Less danger from temporary failure of the oil supply.
6. Less corosion, especially in cylinders.
7. Reduction in maintenance and replacements.
8. Longer useful operating life of the mechanism.
9. Close tolerances maintained.

The coefficient of friction of metal on sliding dry "graphoid surfaces" pro-


PHOTOMICROGRAPH OF PARTICLES OF "dag" COLLOIDAL GRAPHITE DISPERSED IN PETROLEUM OIL ENLARGED 250 TIMES
PHOTOMICROGRAPH OF PARTICLES OF THE FINEST POWDERED GRAPHITE COMMERCIALLY AVAILABLE ENLARGED 250 TIMES

duced from colloidal graphite is little greater than full fluid friction. Colloidal graphite, by reducing the surface tension between metal and oil, will cause the oil to spread farther and will re-establish more quickly an oil film that has been ruptured.

Colloidal graphite is also an excellent high temperature lubricant. Because temperatures at which its liquid carrier is quickly burned away do not affect the graphite or the lubricating value of the graphoid finish which remains. It is therefore very successfully used for the bearings and rubbing surfaces of such equipment as oven conveyors, kiln cars, forging dies, hot piercing tools.

Porous bodies such as wood, ceramic materials, textiles, paper, asbestos packing, leather, porous bearing metals, felt, brake linings, clutch facings, grinding wheels, etc., may be impregnated to varying degrees with colloidal graphite—also it is used as coatings and mixtures with such materials as waxes, soaps, resinous compounds, plastics and rubber.

The purposes of impregnation are to give these materials lubricating qualities they do not otherwise have, make them electrical conductors, increase their heat radiation and heat absorption capacity, to color them or to make them entirely opaque.

It is only because colloidal graphite particles are so very small that they will impregnate many of the materials mentioned. Larger particles could not enter the very small capillary pores and would only be filtered out at the surface.

Being practically inert chemically, graphite does not combine with the material impregnated or other substances coming in contact with it. Consequently, its physical properties remain in the impregnated material.

Its lubricating value, its heat and corrosion resistance, and the fact that it does not combine chemically with other elements, makes colloidal graphite an ideal parting compound, that is, a substance to prevent one part sticking to another due to the action of heat, corrosion, or other action.

Colloidal graphite is especially useful in keeping molten glass from sticking to glass molds; in keeping light bulbs from sticking in their sockets; to facilitate the removal of adhesive from the rolls such, for example, as used in making corrugated paper; and as a parting compound for molding rubber or casting metal. Colloidal graphite keeps bolts, studs and pipe threads in a condition to be unscrewed easily when necessary. It also makes it possible to tighten bolts and pipe connections to a greater extent than is possible without the colloidal graphite treatment.

How to cut special tool cost

by Paul W. Miller
CHIEF ENGINEER
Carboloy Company, Inc.

THERE are many applications where a strictly standard tool cannot be used.

For such applications most manufacturing organizations follow the normal practice of designing special carbide tools "from scratch".

While this is fundamentally the correct practice, it may lead to a higher than necessary tool cost.

Frequently it has been found that tools are designed with tips that differ only slightly from the large number of standards available from stock. The net result is that the cost of producing the tool "as designed" is considerably higher than necessary, since a special tip has to be put through the shop at a considerably higher manufacturing cost.

Following are a few typical examples of such substitutions with the savings involved.

Figure 1 illustrates the savings which were accomplished on a chamfering tool. The solid lines indicate the tip as drawn by the user's tool engineering depart- nearest larger size cemented carbide ment while the dotted lines indicate the standard tip.

The principle of specifying standard tips to save money is also well illustrated in the offset tool in Fig. 2. Here the standard tip is ⅛ in. wider than the special tip with which the tool was designed.

On one order for 100 such tools, the total saving in using standard offset tools would have been $94.00.

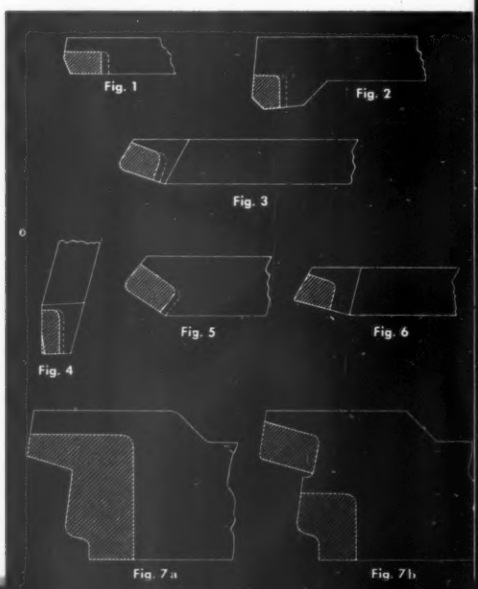
In the example shown in Fig. 3, the larger standard tip indicated would again mean increase in productive life of approximately 20 percent in addition to a saving of $52 per 100 tools used.

The cost of the tool illustrated in Fig. 4 was materially reduced while increasing life by using a slightly wider standard tip of the sam elength and thickness as the special tip specified. The saving per 100 tips here is roughly $23.00.

An even larger saving in tip cost alone is shown in the shell turning tool in Fig. 5. Here again, a standard tip was available just ⅛ inch longer than the special tip indicated. The saving involved in substituting the longer lived standard tip here amounts to $1150 on a single order of 1000 tools with an increase in life of approximately 10 to 15 percent.

Even where quite special shapes are required, standard tips may be specified. The tool in Fig. 6 if produced with a standard tip would considerably reduce cost.

A still better example of the savings possible through the adoption of standard tips is shown in Fig. 7.



MULTI-RANGE GAGE . . .
AID TO ORDNANCE INSPECTION

by Stewart Becker

METRON INSTRUMENT COMPANY

THE electric comparator gage shown in operation below is a device for comparing the dimension of machine parts. Its development is another contribution to industrial inspection.

As each part to be compared with a master is placed on the anvil under the gage point, the indicating instrument reads the variation from the master dimension. The gage is ideally suited to the rapid production gaging of such parts as aircraft and precision ordnance items, including precision tool and die specialties.

Its operation is electro-mechanical. The gage head is raised or lowered on the column and may be revolved in vertical plane at any angle and located in place. A protractor is provided for reading this angle. This makes possible the gaging of irregular shaped pieces. They also have applications in multiple gage set-up.

The head may be removed for use on special gage fixtures. The accuracy of the gage is not affected by variations in the power source since a stabilizing circuit is incorporated. The gage head has no bearing surfaces and there are no parts to wear out. IIn use, the gage is set to size by a master part. The gage head is put to within approximately ¼ of its correct location, then the Vernier adjusting collar at the bottom of the gage head is rotated until the indicating instrument reads approximately zero.. After this setting, the electric zero adjustment is turned until the indicating instrumnet reads exactly. The gage is then ready for use by removing the master the substituting the part to be compared. The part is larger or smaller —the exact difference is shown on the plus or minus scale.

RANGES AND MAGNIFICATIONS

Range	Magnification
0.0002 inches	10,000
Each scale division (0.1 in.) represents 0.00001 inches	
0.0004 inches	5,000
Each scale division (0.1 in.) represents 0.00002 inches	
0.002 inches	1,000
Each scale division (0.1 in.) represents 0.0001 inches	
0.004 inches	500
Each scale division (0.1 in.) represents 0.0002 inches	

The multi-range feature is of particular interest since it has never been incorporated in any electric or mechanical comparator gage. It was formerly necessary to have four gages on hand to cover this range. The pressure of the spindle against the work can also be adjusted from two ounces to two pounds by rotating the nob, calibrated in ounces, on top of the gage head. Once this has been set for the required pressure it remains consistent throughout all four ranges.

MACHINE TOOL INDUSTRY PRESENTS ITS CASE AGAINST RENEGOTIATION

COMMITTEE ON RENEGOTIATION,
NATIONAL MACHINE
TOOL BUILDERS ASSOCIATION

A. G. Bryant, Chairman
James Y. Scott • Joseph L. Trecker

"The machine tool industry approves the principle of eliminating excessive profits, as well as the review of contracts to determine to what extent excessive profits may have accrued. It objects to the methods used by the Price Adjustment Boards in their renegotiation procedure, because if they persist in these methods they will deprive machine tool companies of earnings needed to weather the impending post-war machine tool depression.

"As enacted by Congress, the renegotiation law provides that the manufacturer and the Price Adjustment Board shall come to an agreement as to the amount of the manufacturer's profits that are excessive, and that therefore should be returned to the government.

"The return is assumed to be made voluntarily. In actual experience the machine tool builder submits his facts and figures and the Price Adjustment Board then determines the amount of money he must pay.

Original Purpose of Renegotiation

"It seems clear that Congress set up the machinery of renegotiation for the particular purpose of recovering a larger share of "windfall" profits than would be recovered by taxes alone.

"The machine tool industry does not object to the principle of recovery of excessive profits. In the machine tool industry, just as in many other industries during the war, the unexpected increase in volume has made possible dollar profits larger than anticipated. It is believed that in some cases a larger share of such profits than is taken by taxes should be returned to the government. The industry disagrees with the Price Adjustment Boards on the *amount* of profits to be returned.

"A portion of these profits represents earnings that under other circumstances than war would have been made over the next ten years or more; war production having simply anticipated the country's normal requirements of new machine tools by that amount. The industry seeks to retain against those next ten or more lean years a reserve sufficient to enable it to carry on, believing that a broken machine tool industry may cost this country its supremacy in productive efficiency.

In presenting this article the Editors of the Tool & Die Journal believe the following viewpoints are constructive and of interest to all industry. The Committee representing the Machine Tool Manufacturers requests recognition of the special problems their industry must meet.

"The industry therefore seeks to retain sufficient earnings to set up reserves against the impending post-war machine tool depression. This the Price Adjustment Boards have thus far been unwilling to grant.

Effect of the Excess Profits Tax

"In the Revenue Act, Congress has established the rate of profit for the years 1936 through 1939, as a 'normal' level against which to measure the amount of earnings that shall be subject to a 'normal' tax. An 'excess profits tax' is then applied to all earnings above that amount, of which ten per cent is earmarked for return to the taxpayer after the war is declared ended.

"The excess profits tax is fair enough in principle. It makes no allowances, however, for the fact that in some business variations from year to year are more extreme than in others in output or services rendered.

"The machine tool builder regards the excess profits tax a form of renegotiation, insuring against the likelihood of anyone in this industry making excessive profits out of this war.

"To make a bad matter worse, the Price Adjustment Boards not only give no consideration to the effect of taxes, but they, too, use the tax-base years 1936 through 1939 as a measure of what a company should regard as a "normal" profit before taxes. So the unfortunate machine tool builder who had a relatively low profit in these years is twice penalized; first by the excess profits tax itself, which exacts a larger percentage of his earnings than from most companies, and again by the Price Adjustment Board's policy of basing his allowable earnings before taxes on the 1936-39 experience, which bears no relation to his contribution to the war.

Profits Before Taxes

"When the Price Adjustment Board announces that a company has been allowed to retain 15% profit on readjusted sales, it means 'profits before taxes'.

"Actually there is no such thing as profit before taxes. In the minds of business men, or the people who have put their savings into the common stock of a company, a 'profit' is the amount left after all costs have been paid. None of the earnings are available to the investor until the taxes have been paid.

"Because of the unequal workings of the excess profits tax, the company that is allowed to retain 15% 'profit on readjusted sales', which may be but 11% on its actual gross income for 1942, may retain only 3% after taxes are paid. And it is out of that 3% that the company must provide reserves against future operating losses before those who have invested their money in the enterprise may receive one dollar in dividends earned.

"The resolute insistence of the Price Adjustment Boards that only 'profits before taxes' can be considered or discussed has one important result. It creates the impression that the boards are far more generous to the manufacturer than they really are.

Ratio of Profits to Net Worth

"The Price Adjustment Boards make a great point of the ratio of profits to net worth. This ratio taken by itself is meaningless.

"The 'net worth' of a company is nothing more than the difference between its assets and liabilities. For example, suppose that a company has net assets of $100,000 and liabilities of $80,000. Its 'net worth' then would be $20,000, which is invested in buildings, equipment, inventory, and cash or liquid assets. Suppose in a given year that company earns a profit of $4,000. That profit could be stated as '20% of net worth'.

"Now suppose this same company, under the pressure of war expansion, borrows $100,000 and puts up a new plant. In that case it has added $100,000 *both* to its assets (investment in plant) and its liabilities (the notes covering the borrowed money). Again subtracting its total liabilities from the total assets we still get a 'net worth' of $20,000, but the company may have done twice its former volume of business, and therefore its profit may be $8,000 instead of $4,000. Its profit on net worth would then have increased from 20% to 40%. In other words, by increasing its debt risk and to that extent jeopardizing its financial position to meet the exigencies of the na-

tion's war needs, it has doubled the amount of its profit in relationship to its net worth.

"Is the ratio of profit to net worth a proper basis upon which to consider the amount of profits to be recovered by the government through renegotiation? If this ratio is to be taken seriously it means that the company which has gone into debt the deepest and is in most need of funds with which to make repayment is the very company which should have the largest share of its profits taken away by renegotiation.

"Under the pressure of war demand the machine tool industry could not have attained the requisite degree of expansion without the investment of additional funds. In view of the post-war outlook it must be borne in mind that the companies which added new capital, either their own or borrowed funds, for expansion purposes have greatly extended their risk as far as the future is concerned.

Renegotiation Payments in Cash

"Many people apparently have the idea that net profits exist in cash. This is rarely the case.

"By way of illustration—consider the machine tool company which is permitted after taxes and renegotiation, to retain a nominal profit. In what form is this profit.

"On the basis of average experience in the industry, the probability is that at least three-fourths of this profit exists in the form of buildings, equipment and machinery, materials and supplies, and parts of the products in process of manufacture.

"Suppose peace is declared tomorrow.

"Can a company meet a pay-roll out of buildings, equipment and inventory?

"Can a company finance a program of research, development, redesign and merchandising, out of buildings, equipment and inventory?

"Is there any way when the war is over whereby a machine tool company can convert that portion of its profits represented by buildings, equipment, and inventory into actual money without borrowing, and further extending this risk or selling at a substantial loss?

"The extent to which net profits are represented by buildings, equipment and inventory brings to the fore another difficulty of renegotiation; the fact that renegotiation payments must be made in cash.

"Where is it going to get the money?

"A company cannot pay either taxes or renegotiation refunds in bricks, machines or parts. It must makes its renegotiation refunds in actual money.

The Arbitrary Nature of Renegotiation

"In considering renegotiation, it must be borne in mind that unlike tax procedures, renegotiation is not a matter of mathematical formula.

"Our tax laws specify certain percentages of earnings which must be returned to the government.

"But under renegotiation, the additional amount of earnings which must be returned to the government is purely and solely a matter of the *judgment* of the Price Adjustment Boards. In short, renegotiation becomes a matter of taxation by men rather than taxation by law.

Effect Upon Machine Tool Builders

"The machine tool builder appears before a Price Adjustment Board with four critical problems which remain unsolved:

1. Because of his large increase in volume by comparison to the pre-war tax-base years, he is subject to an excess profits tax higher than that of many other manufacturers.*
2. Now that Defense Plant Corporation business is included under war contracts, the percentage of business which will be construed by the Boards as subject to renegotiation will be higher than for a manufacturer in most other industries.
3. He has sold out his market for the next 10 to 15 years—whereas many other manufacturers, especially those in consumer goods fields, are looking forward to an enormous post-war demand for their products.

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*The machine tool builders are not alone in this. Excess profits taxes bear heavily upon many other production equipment industries. The whole group faces conditions similar to those ahead of the machine tool industry, and has a like need for special consideration under renegotiation.

4. Competition of war built machines in the new machine market already has begun. Machine tools built for the production of war material even now are being converted to production of peace-time goods. Examples may be cited of machines used less than a year on war work, and now turned to the production of peace-time equipment.

The Remedy

"The machine tool industry urges immediate Congressional action. It is apparent that the remedy should take the form of an amendment to the renegotiation law. The following principles are suggested:

1. Renegotiation on the basis of profits before taxes should be abandoned. Agreements should be made wholly in the light of profits after taxes. Any other approach brings disagreements and demands that are inequitable and unjust.
2. The extent to which a company's product is expendable in the war effort should be taken into consideration in determining the amount of the company's earnings to be recovered by the government through renegotiation. In short, due allowance should be made for the peace-time use inherent in the equipment after the nation's war needs have been met.
3. Companies which have saturated their post-war markets by reason of their war-time production should be permitted to retain out of their earnings the reserves necessary to maintain their service to the industries dependent upon machines already installed, to finance the engineering research that leads to new developments. Only by this means can the American machine tool builders maintain employment and restore their market position in the post-war period.

"There is to be considered, in this connection, not only the responsibility of the machine tool and similar equipment industries to maintain employment and train men, but the fact that the capacity of this nation to produce machine tools of great accuracy, produce them quickly, and in quantities as needed, is essential to national defense and to a sound national economy."

Precision Molds Shape Plastics to Specifications
Precision, as applied to ELECTRIX molds, has special significance, because as the makers of Precision Authenticators which are accurate to within .00005 of absolute, "near enough" has no place in our plant or in our thinking.
It is possible that products or parts which you are now making of other materials could be made in less time, at less cost, and with a gain in dependability, if precision-molded in plastic from ELECTRIX molds.
If you will send samples, or give us details, we'll gladly give you an opinion and suggestions based on our experience.
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150 MIDDLE ST., PAWTUCKET, R. I.

Industrial Digest

TOOLING • PRODUCTION • WAR NEWS • PUBLICATION REVIEW

Non-Sparking Safety Tools

MANY industries are turning with interest to the comparatively new "safety tools" which have come on the market within recent years. In all those industries where, for instance, explosive, Inflammable and highly volatile materials have to be handled and where there is the ever-present danger of fire or explosion, the utmost precautions against electricity failures, naked lights or smoking by personnel may be taken; but there always remains the possibility of an iron or steel tool such as a hammer, chisel or spanner, etc., slipping and causing a fatal spark.

Since the last war there have been developed a number of extremely tough, very hard and very strong alloys of copper suitable for making engineering tools, notably those known as beryllium bronze or beryllium copper and manganese bronze.

The term bronze is one that requires slight further explanation. Although it originally referred strictly to an alloy of copper with tin, in modern metallurgy any alloy which consists essentially of copper hardened, toughened or strengthened by the addition in suitable form of small amounts of other elements such as beryllium, manganese, tellurium, etc., may be called a bronze. The term "high tensile bronzes" is a convenient expression to differentiate these non-tin bearing copper alloys from the ordinary bronzes. In this article it is proposed to deal only with the use of beryllium bronze in the manufacture of non-sparking tools.

Beryllium itself is a comparatively little known metal, having a steel-gray color slightly akin to that of aluminum and magnesium. It is 1.85 times as heavy as water and is, therefore, about the same density as magnesium although it is only two-thirds as heavy as aluminum. The principal reason that beryllium has not achieved the great industrial importance of the other light metals, even with the impetus of the phenomenal demand for light constructional materials for aircraft, is that there is only one ore of the metal and that is the mineral beryl, precious varieties of which are the familiar emerald and aquamarine. Furthermore, beryl is by no means a common mineral and at the best contains only about 4% of beryllium.

Beryllium has come into metallurgical prominence because only relatively small amounts are required to produce an extraordinarily large improvement in the mechanical properties of copper. The actual amount of beryllium in modern beryllium bronzes is never more than obout 2.75% and it is introduced into the copper, not in the form of beryllium metal, but as a "master alloy" of copper with about 4% beryllium. This master alloy is comparatively easily prepared by the thermal reduction of beryllium oxide in the presence of copper.

Consisting as it does in this country of 97.75% copper, beryllium bronze is a non-sparking or "non-pyrophoric" alloy (lighter "flint" which consists of ferrocerium is a popular example of a pyro-

(Continued on Page 134)

INDUSTRIAL DIGEST

(Continued from Page 133)

phoric alloy). Even when held against a fast-turning grindstone there is a complete absence of the shower of wheel-like sparks so familiar when sharpening steel tools. It may be emphasized here, however, that such treatment should never be meted out to a beryllium bronze tool, as the heat of the friction generated would be sufficient to upset the dispersion of the beryllium through the copper and spoil the cutting edge which could then only be reconditioned by heat treatment again. These tools are kept cool, therefore, during regrinding, and wet-stoning or filing is to be recommended. Even if, in actual usage, small fragments of the alloy were to become detached, overheated or ignited by excessive abrasion and friction, the minute sparks would be very short-lived owing to the high thermal conductivity and non-pyrophoric properties of the alloy and the rapid dissipation of the heat by radiation.

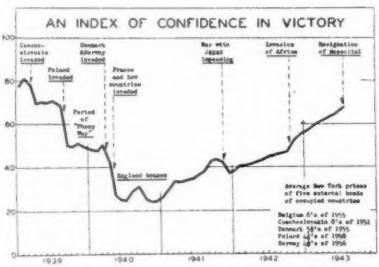
The principal industries in which these non-sparking tools are finding important applications are those concerned with the treatment, storage and transportation of explosives, highly volatile solvents, cellulose lacquers, paints, oils of all types, as well as in oil tankers, and sewers.

Condensed from "Non-Sparking Safety Tools, An Important Application of Beryllium Bronze" originally published in Machinery Lloyd, England.

Confidence

A new index of confidence is shown in the diagram right. It reflects changes over the past five years in the degree of confidence of American investors that our side will be victorious in these wars and that countries now occupied by the Nazis will be restored to peace and to productivity. The line in the diagram shows for each month since the beginning of 1939 the average price in New York of five external bonds of occupied countries. The bonds used in making the index are listed within the diagram.

During the first quarter of 1939 the average price of the five bonds was about 80, and it would have been 100 or above if the bonds of Czechoslovakia and Poland had not already fallen to levels far below par. In the spring of 1940 there took place the invasion of Denmark and Norway, the low countries, and France, and the average price of the five bonds fell to below 25. When 1941 began, and England had not succumbed or been invaded, some courage-



ously speculative investors began to pick up bargains in foreign bonds, and the average price started on the long upward trend which is still under way.

All five of the bonds declined in price toward the close of 1941 and it is interesting to note that the decrease in the average began in November rather than in December, when we entered the war. The average price in November was about half as much as it had been at the beginning of 1939. The advance since our entry into the war has been steady and rapid.

Roy W. Thompson

Many will regret the recent death of R. W. Thompson, well known representative for The Tool & Die Journal in the states of Ohio, western Pennsylvania and western New York for the past several years.

A new representative who will cover

this territory will be announced shortly. In the meantime, please call on us if we can be of service.

"E" for Excellence

The roster of companies receiving the coveted Army-Navy "E" award admitted the name of Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago, Ill., within the past few weeks.

Manufacturers of grinding wheels and mounted wheels, it is no doubt that their claim of "Half a century of specialization has established our reputation as the Small Wheel People of the Abrasive Industry" justified this award.

Third War Loan

The Advertising and Publicity Division in Washington has detailed plans for the most extensive and intensive national advertising and publicity campaign in our history for the Third War Loan Drive. Our national quota of 15 billion dollars is to be raised entirely from non-banking sources. State by state quotas will be assigned in terms of (a) sales to individuals as distinguished from corporation and institutional investors, and (b) sales of series "E" bonds as distinguished from all other securities. There will, however, be no such breakdown of the national quota.

The drive to reach individual investors should be intensive and continuous throughout the entire period. Reporting of subscriptions will extend up to a week following the closing date of the drive. To make our individual quota, an average investment of an extra $100 E bond during September for every American now receiving regular income (excluding members of the armed forces) must be obtained. Also, accumulated funds now being held by individuals, corporations, institutions and associations must be solicited.

The War Finance organization uses two direct methods of promoting bond sales: 1. advertising, promotion and publicity of all kinds, and 2. personal solicitation. Both are to be intensified during the September Drive.

Centering around the official slogan, "Back the Attack—with War Bonds," the Third War Loan publicity, designed to appeal to the individual's patriotism and self-interest and to prepare him for a direct, personal appeal to buy bonds, will include: advertising news and editorial space in newspapers; more than ten thousand hours of radio time; forty-eight thousand 24-sheet billboards; full page advertisements in all leading farm magazines, business publications and general magazines; editorial space in more than twenty-five thousand house organs; news reels and short subjects in motion picture houses; displays in lobbies, drugstores, grocery stores, liquor stores and department stores.

In planning the Third War Loan campaign, however, it is important to remember that the best conceived and administered program of advertising and publicity cannot make our quota for September—unless it is carried directly to every individual American by a personal appeal to buy bonds.

An official survey following the Second War Loan Drive in April showed that in spite of the intensive general appeals to "buy an extra bond in April" only 17% of those who were not personally solicited responded by actually buying extra bonds. But 47% of those personally solicited did so.

The most important task of every War Finance Committee during September will be to conduct a campaign of solicitation that will reach every potential bond buyer in its territory. A successful canvass of this magnitude will require not only an efficient organization for carrying on the solicitation, but the direct and prompt response of every American as well.

(Continued on Page 184)

PROGRESS ON P

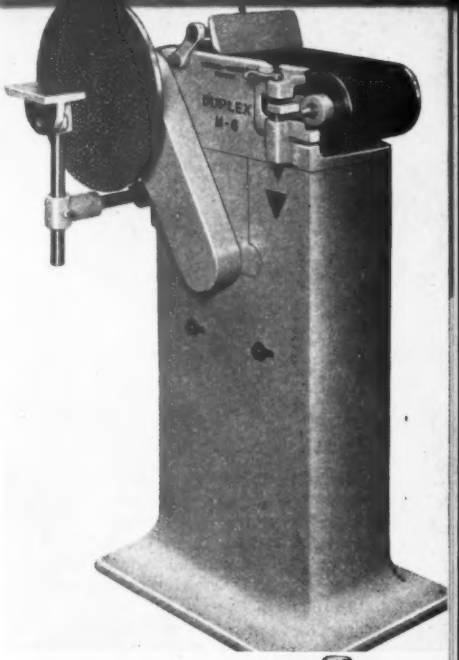
THE Greenfield Tap and Die Corp. (below, left) offers its new No. 1618 Rapid Inspection Limit Snap Gage for quicker inspection of precision parts with less wear on the gage. An extended anvil allows the work to be readily located and leveled before moving towards the "Go" and "Not Go" anvils, thus facilitating inspection. This advantage applies both to measuring diameters of round parts and to gaging external lengths. The extended anvil also facilitates gaging work in the machine, which is an especially timely introduction now when rapid, reliable gaging is important as never before. Write Greenfield Tap and Die Corp., Greenfield, Mass., for complete details. **108-C**

A RECENT development on the market is the new model of the Wilder Projector (bottom right) containing a 2" diameter condenser. This condenser provides a larger beam of parallel light than the 1½" diameter condenser previously used and permits the use of larger diameter lenses in the lower-power series. A newly designed, fully enclosed head with a more streamlined and better ventilated lamp house has also resulted from the larger condenser. Spiral gears are now used in the focusing motion, assuring the maximum smoothness of operation. Full information may be obtained from George Scherr Co., 128-B Lafayette St., New York, N. Y. **490-C**

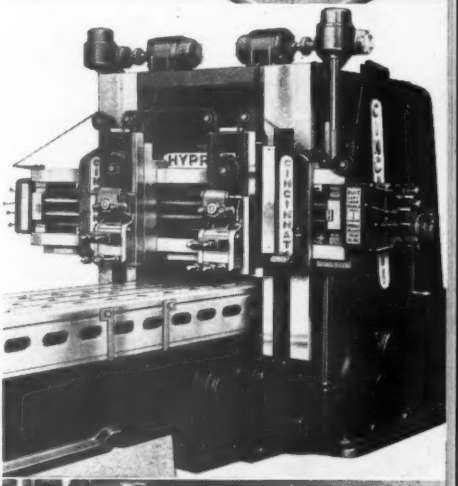
THE Duplex-M-6 Model abrasive band and disc combination grinder (illustrated at top of next page) manufactured by Walls Sales Corp. is actually two machines built in one and built for production. It permits the rough grinding being done on the disc and the finishing operations on the abrasive band. Band tension is automatically controlled by a time-tested, positive acting tension spring arrangement and single action thumb screw assures perfect belt alignment. Walls Sales Corp., 97 Warren St., New York, N. Y., will send available literature on request. **547-C**

THE Challenge Machinery Co.'s announcement of a new turn table is welcome news because it fills a long felt gap in machine shop work. This table is ideal for the progressive mounting of two or more units at one time and for continuous production. A radial drill can be performing the drilling and tapping operation while another unit is being mounted and locked into place. Two models are available — one is mounted on a cast iron stand as shown at the bottom (left) of the next page, or a low base for use on machine beds. The Challenge Machinery Co., Grand Haven, Mich., has literature available. **431-C**

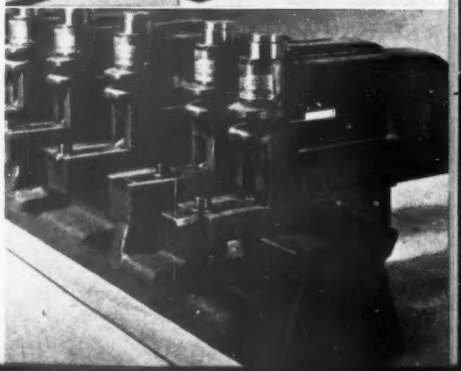
PARADE



FORTY-FIVE years of manufacturing experience has made possible the development of the new Cincinnati Hypo Frog and Switch Planer which contains many improvements in heavy duty planer construction. This planer is equipped primarily for Hypro-duction and the greatest possible rigidity in withstanding the heaviest cuts. Among its many features is the double length enclosed bed with extra deep housing cheek bearing to the bed. The table is of greater depth and is provided with full length hold down gibs. Complete information on this planer (shown at right, middle) is available from the manufacturer, Cincinnati Planer Co., Dept. 9T, Cincinnati, O.
55-C



THE Wales-Strippit Corp., 355 Payne Ave., N. Tonawanda, N. Y., announces their Type "B" Hole Punching Units with new adjustable adapters for punching holes in flat sheets. The illustration at the bottom (right) shows the punching units bolted to the adjustable adapters which are mounted on press brake rail, providing straight line hole punching patterns. Wales Type "B" Hole Punchin gUnits are designed for interchangeable use on press brake rails with adapters and T-slotted plates and templates in punch presses.



SAVINGS of high speed and other alloy steels ranging from 50% to 80% per tool are now possible through the development of a composite steel by the Jessop Steel Co. The composite consists of a section of alloy steel continuously and permanently bonded to a backing of mild steel. The proportions of alloy section are controllable. Illustrated above is a Jessop high speed composite tool steel in bar form which has been machined, along the entire length, to specifications for a forming tool. It is then cut into desired lengths for individual tools. The machining is all done on one piece at the same time. For further information, write Jessop, Dept. T, Washington, Pa. **259-C.**

INCORPORATING all the outstanding features of the popular Hammond "600" Dri grinder, the new improved 6" Wet-N-Dri machine (bottom, left) provides in addition wet operation for grinding, polishing or surfacing. It is equipped with tank and pump unit and can also be equipped for water-main connection only. Totally enclosed for safety, the machine can be adjusted from vertical to horizontal position while running. The belt tension and tracking device can likewise be adjusted while running. Squaring, chamfering, forming radii, grinding flat surfaces, rounding, polishing and removing shaper marks are a few of the production operations being done on abrasive belt grinders. Wet grinding permits faster cutting at lower costs and prevents discoloration, fracturing, chipping and warping. For further information, write Hammond Machinery Builders, Inc., 1631 Douglas Ave., Kalamazoo, Mich. **95-C.**

THE powerful hand bench press, illustrated second from the left, is fitted with an automatic numbering head with special trip cam arranged for consecutive, duplicate or whatever type of numbering is required, for the matching of small parts with the same serial number. The unit shown is assembled with duplicating head for numbering two mating parts of spark plugs for aircraft engines. The modified toggle lever movement enables the operator to exert considerable pressure for marking hard parts, yet at the same time control that pressure so that delicate watch and instrument parts can be numbered or marked without harm. For full details, write Wm. A. Force & Co., 219 Nichols Ave., Brooklyn, N. Y. **293-C.**

MIKRO-LOK boring bars (second from right) are especially adapted to boring a shoulder or the bottom of a hole. They are also efficient for making intermittent cuts. The blade protrudes beyond the end of the bar, thus permitting chips to readily fall ahead of the bar. Within the bar is a unique micrometer adjusting dial by which the blade can be set—and locked—to very close

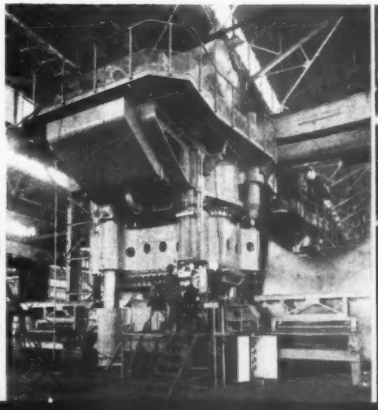
limits. For full information write to the Universal Engineering Co., Dept. T-D, Frankenmuth, Mich. **276-C.**

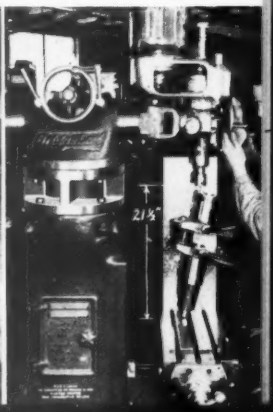
DESIGNED for deeper immersion the vertical "Gusher" coolant pump, shown at the extreme right on the preceding page, is capable of handling soluble coolants containing grit and abrasives without injury to the mechanism. The unit, with greater immersion length, is provided with an integral mounting flange which is usually bolted to the reservoir cover or bedplate. This forms a simplified installation in connection with a comparatively deep reservoir which is frequently arranged below the floor level. No packing glands or friction seals are used, nor are there any bearings or metal-to-metal contacts below the mounting flange. Extensive tests have proved liquids containing abrasives can be safely handled without injury to the pump. For further details, address The Ruthman Machinery Co., 1808 Reading Rd., Cincinnati, O. **318-C.**

A SURVEY by Farval Corp. indicates that previous skill and experience are not necessary with centralized lubricating systems and that women can learn to operate them in a half-hour or less. By supplying a large number of bearings from a pressure pump, it is possible to lubricate as many machines as 10 oilers can service by hand in the same time. Thus one woman can release a number of men to other essential activities. By the centralized system oil or grease is delivered to bearings on machines of any type or size. Each bearing receives a positive charge of lubricant at regular intervals and none is missed. A woman is shown, left, operating one of the Farval systems. Full details will be supplied by The Farval Corp., 3245 E. 80 St., Cleveland, O. **413-C.**

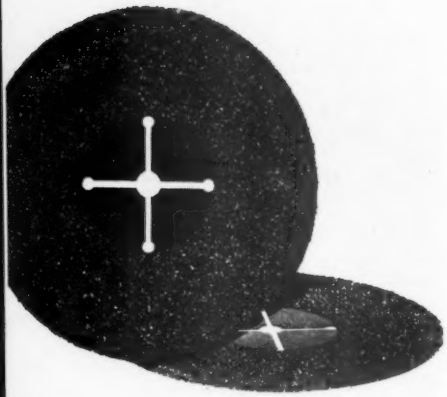
BULKY work requiring only a light cut that normally ties-up bigger machines can be handled on a Bridgeport milling machine, when a "Hoover-Riser" has been installed. The Riser increases the over-all capacity of the Bridgeport machine six inches without at all impairing its rigidity. It is made of a grey iron casting. Recessed and drilled to fit this standard machine, and bolted in place, it becomes an integral part of a Bridgeport. The photo at the right shows a small hole being bored on an angle in a crankshaft, an operation that otherwise would have to be done on a multi-thousand-dollar horizontal boring mill. Write to the Hoover Tool & Die Co., 20556 Hoover Rd., Detroit, Mich., for further information. **480-C.**

THE massive 5,500-ton capacity Southwark hydraulic press (center below) is one of three just completed by Baldwin especially for forming Duralumin aircraft parts. The rapid-action press is completely automatic, having control of pressure, operating speed and length of stroke. It is equipped also for semi-automatic or manual operation. Press platens are single steel casting and weigh approximately 160,000 lbs. each. Electric motors, with a total of 400 hp, are required to operate the pumps located on the platform (30′ x 23′) which supports the complete power unit, control gear and operating valves. For full details, write The Baldwin Locomotive Works, Baldwin Southwark Division, Dept. D, Philadelphia, Pa. **131-C.**

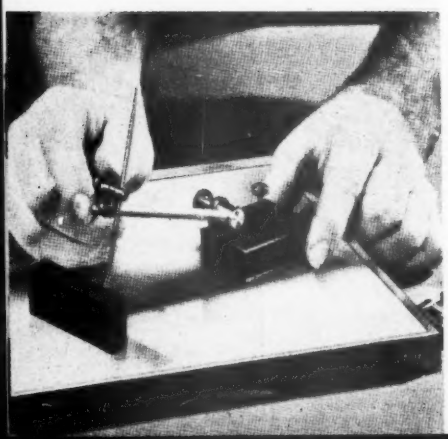




FOUR styles of tools are available in the complete line of standard tungsten carbide tipped tools of the New England Carbide Tool Co., 60 Brookline St., Cambridge, Mass. This line includes both right- and left-hand as well as pointed and square tipped tools. These are regularly furnished in "U" grade for cutting all materials except steel, such as aluminum, cast iron, brass, bronze, non-metallics, etc., and in "S" grade for cutting steel. These standard tools or special tools can also be supplied by this company with any make or grade of carbide specified by the customer. Complete details are available. **58-C**



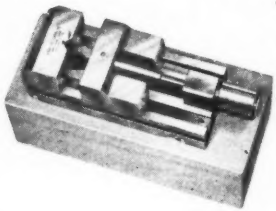
EXTENSIVE pioneering in the development of a finer, better abrasive diss has resulted in the production of Marvel Abrasive Sanding Discs, shown at the left, recently announced by the Fibre Abrasive Corp., 1132 East 74th St., Chicago, Ill. These discs are made of tough, sharp-cutting aluminum oxide grit, firmly bonded with a heat resisting resin to a chemically treated, super-pliable, genuine fibre back. A resin bond will not soften under high frictional heat. The discs are, therefore, extremely hard and tough and require less cleaning and replacement than the conventional glue-bond disc. Marvel Abrasive Sanding Discs are designed for high speed continuous work. They are available in diameters ranging from 6" to 30" and in all grit numbers. Literature will be sent on request. **548-C**



MANY unique advantages are presented in the new surface plate perfected by Cadillac Glass Co. These are made of solid plate glass, thus saving critical materials. As the glass wears, it shows only scratches unless densely grouped. Resurfacing is unnecessary. Much time is saved in the use of Cadillac glass plates by having desirable details and data etched on the under side. In addition to their low cost, these plates do not requrie oiling or demagnetizing and their accuracy can be easily checked. For complete details on these surface plates, shown at the left, write Cadillac Glass Co., 900 W. Cermak Rd., Chicago, Ill. **549-C**

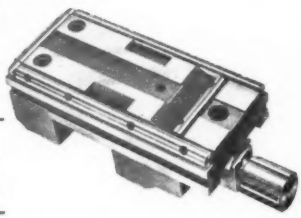
THE ANGLEMASTER SINE VISES

(Patented June 1, 1943) Patent No. 2320606



1-way No. 2 Heavy Duty, Price $95.00

No. 3 Tilts Three Ways, Price $145.00



Skilled tool, gage and die makers and inspectors will immediately recognize the utility and numerous advantages of the ANGLEMASTER SINE VISE. Manufactured from suitable steel, heat treated and seasoned before finishing, this unique vise embodies the features of a rugged useful tool and a precision gage.

The ANGLEMASTER quickly and accurately handles angle grinding, inspection or layout. It is ground and lapped to be perfectly level, parallel and square, thus finding a wide variety of useful applications throughout the tool shop, gage, die and inspection room.

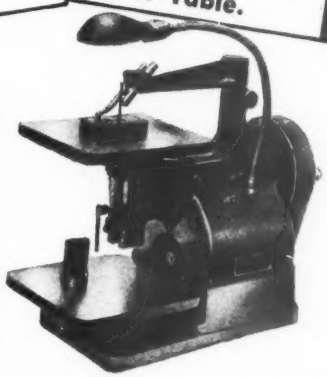
EXCLUSIVE NEW FEATURES INCLUDE:

1. **The Precision Sine Rolls,** which permit quick accurate angle setting. In grinding, ordinary magnetic chucks will securely hold the Anglemaster set at any angle by means of a size block or planer gage and without strapping or clamping devices. A small block of steel placed on the chuck in front of the tilted vise positively assures hold with no change of setting.
2. **The Non-Projecting, fully covered, Telescoping Screw,** which provides pressure to the slide jaw where it is most efficient and effective.
3. **The Removable Grip Screw Knob,** held in place by an internal spring and easily detached after work is correctly set, thus insuring against accidental changes in setup.
4. **The Slide Jaw,** lapped to a precise fit, which will not raise the work.
5. **An Accurate Integral V-Block,** provided by a V-slot in the exact center of the fixed jaw.
6. **Tolerance .0002".**

TWO MACHINES IN ONE!

For Die-Filing Use Top Table in Position Shown.

For Punch or Blind-Hole Filing Tilt Top Table Back, Use Lower Table.



DIE TABLE Filing From Below

PUNCH TABLE Filing From Above

No more hand filing of intricate jobs or inaccessible parts! With this Duplex Die and Punch Filing machine you can take care of all filing and lapping jobs as they come along. Stroke fully adjustable from 0 to 1½". Two Speeds. Fully enclosed motor. Ball Bearings throughout. No dripping of oil. No waste of unused file sections.

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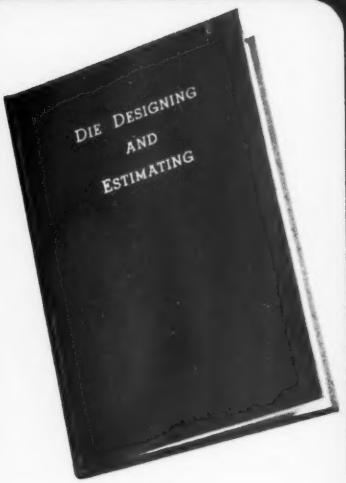
IDEAL MACHINE TOOL COMPANY - 735 CONGRESS STREET SCHENECTADY, N. Y.



DIE DESIGNING AND ESTIMATING

CONTENTS

New Chapters include: Progressive Dies; Compound Dies; Drawing Dies (*Deep drawing section on cartridge case design, mathematical and graphical methods of determining diameters, shell wall thicknesses, punch and die sizes*)
Outline of Equipment and Operations for Manufacture of Small Arms Cartridge Cases.
15 New Estimating Tables.
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The 160 pages have over 125 drawings, charts and photographs carefully selected to illustrate modern die designing practice. The estimating data (largely that of George Dannes) is complete enough to follow from rough sketch to a final, sound estimate.

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Remember—Webber is the largest exclusive manufacturer of Gage Blocks. Webber Gage Blocks are produced with the most modern equipment—under ideal conditions—by men experienced in the craft.

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Set No. 84 contains 84 blocks in sizes from .050″ to 4.000″. Range .100″ to 12.000″ in steps of .001″, .200″ to 12.000″ in steps of .0001″.

Price Set No. 84A—$350.00
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Set No. 43 contains 43 blocks in sizes from .100″ to 4.000″—ideal for tool rooms and small shops. Range .200″ to 10.000″ in steps of .001″, .300″ to 10.000″ in steps of .0001″.

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All "A" accuracy sets are accurate within .000004″—all "B" accuracy sets within .000008″.

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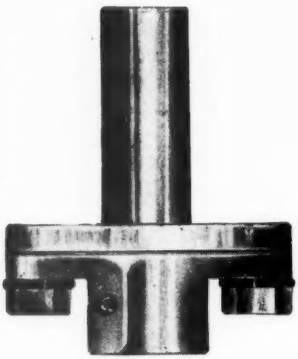

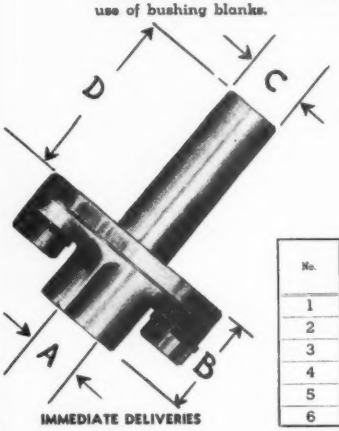

IMMEDIATE DELIVERIES
ON PRIORITY

Specifications

No.	A Diameter of Hole for Tool in Inches	B Length of Body in Inches	C Diameter of Shank in Inches	D Length of Shank in Inches	Price Each	Bushing Blank Price Each
1	1/2	27/32	5/8	1 1/8	$ 6.00	.55
2	5/8	1 1/8	3/4	2	6.25	.55
3	1	1 1/2	1	2 1/2	7.95	.65
4	1	1 1/2	1 1/4	3	8.65	.65
5	1 1/2	2 19/32	1 1/2	3 1/4	15.00	.85
6	1 1/2	2 5/32	1 3/4	3	20.00	.85

The above specifications chart provides an easy and efficient way to order.

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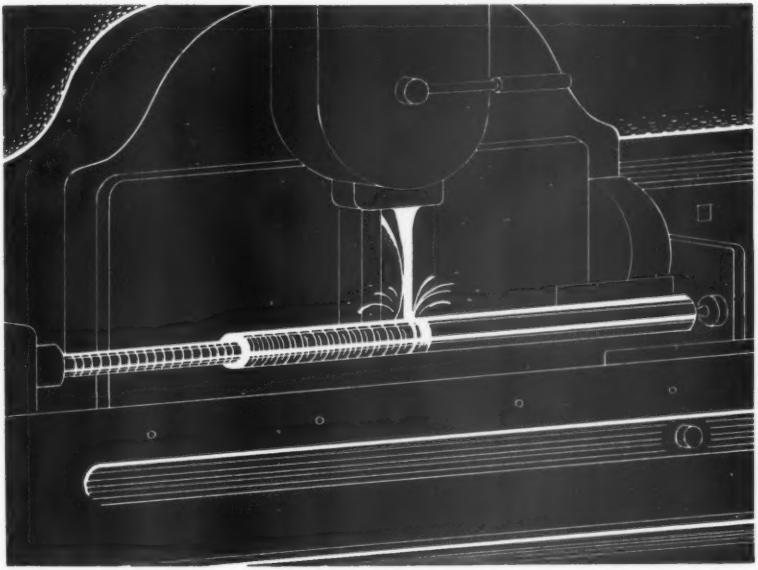

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Gilron engineers have developed an oil (coolant) to materially increase production speed and output of inspector-approved work.

As a tailor-made product it is adjusted to meet the working conditions of each plant according to material ground, finish, grinder and desired speed and feed.

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Publication Previews

SALES AND TECHNICAL LITERATURE

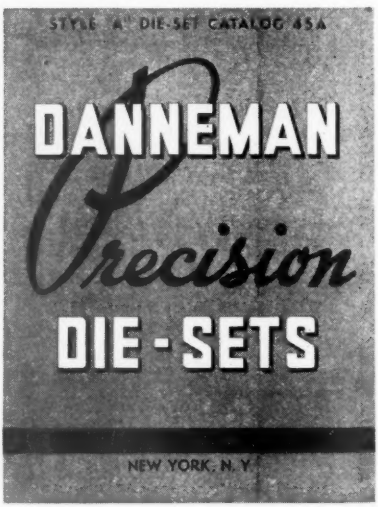
Send Request on Company Letterhead

TOOL AND DIE MAKERS' AND MACHINE SHOP SUPPLIES—are listed for delivery in the new 2-color 20-page catalog just issued by Die Supply Co., 4751 Hough Ave., Cleveland 3, O. This catalog, over twice

as large as its predecessor, now gives a complete listing and description of this firm's warehouse facilities for users of these materials. **550-C**

DESIGNED FOR RAPID, ECONOMICAL wet or dry grinding are two new carbide tool grinders manufactured by Willey's Carbide Tool Co., Dept. E, Detroit, Mich. Model 30 is designed for eight-inch vitrified wheel for rough and semi-finish, and six-inch diamond wheel for finishing. The Compact Willey's Model 50 Bench Grinder is designed for wet or dry grinding of tungsten carbide tipped tools as well as other types of tool bits ranging up to a maximum 1¼" sq. or equal cross sectional area. Illustrations and specifications of both models are presented. **551-C**

DANNEMAN PRECISION DIE-SETS—A new catalog giving detailed facts and specifications on Style "A" Die-Sets has recently been issued by the Danneman Die-Set Company, New York, N. Y. Some of the outstanding features listed are: even inch punch and die space; shank located on



center line of punch and die space; machine finished clamping U-lugs; and flange all around die shoe convenient for additional clamping. Requests for Catalog 45A will be answered promptly. **552-C**

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Tool and Die Journal, 2460 Fairmount Blvd., Cleveland 6, Ohio

Please send me the literature I have indicated.

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THE TOOL & DIE JOURNAL

2460 FAIRMOUNT BLVD. • CLEVELAND 6, O.

THE AMAZING STORY OF FINE PRECISION WORK—on a mass production basis is told in a new booklet just gotten out by the Ace Manufacturing Corp., Erie Ave. at K St., Philadelphia, Pa. Describing in detail their precision grinding, production machining, metal stamping, heat treating and tool and die work, it is a typical example of the giant strides industry is making under the

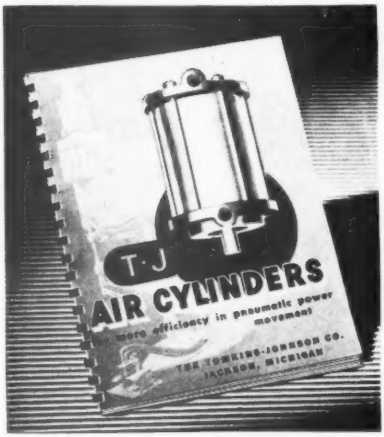
exacting demands of war-time production. Manufacturers are asking for precision which used to be impossible, for tolerances as close as .0001", for finishes which a speck of dust or a warm hand distorts—and Ace is turning them out by the thousands on 24-hour-a-day, and 7-day-a-week schedules. A copy of this new booklet will be gladly sent to manufacturers requesting it on their company letterhead. **136-C**

HOW TO MAKE YOUR GAGE BLOCKS LAST LONGER—is the theme of a recent informative booklet by Dearborn Gage Co., Dept. T, Dearborn, Mich. A simple, yet complete explanation of the stoning of gage blocks—an operation which not only prolongs the life of their chromium plated blocks, but which also saves valuable time in less rejects due to imperfect readings is depicted. **139-C**

AMONG THE MANY NEW FEATURES INCORPORATED—in the Anglemaster Sine Vises are: precision sine rolls for quick accurate angle setting; non-projecting and fully covered telescoping screw, which provides pressure to the slide jaw where it is most efficient and effective; removable grip screw knob, held in place by an internal spring and easily detached after work is correctly set; the slide jaw, lapped to a precise fit, and an accurate integral V-block. Further information including specifications and illustrations are presented in a leaflet issued by Ideal Tool & Machine Co., 738 Congress St., Schenectady, N. Y. **147-C**

AN EXCEPTIONALLY WELL-ORGANIZED—booklet discussing Holden Liquid Carburizing Baths for temperatures from 1450° F to 1750° F has been issued by A. F. Holden Co., Dept. J, New Haven, Conn. A partial list of parts and tools processed in these liquid carburizing baths include aircraft parts, bushings, casters, die casting machinery, machine screws, pneumatic machinery, dies for plastics, stampings and many others. Necessary instructions for operating such baths along with a description of the different results to be obtained at various times and temperatures are given. All of this practical data was obtained from actual operation and would serve as an excellent guide in production. **150-C**

NEW AIR CYLINDER CATALOG—a new 92-page catalog describing T-J air cylinders is now available for distribution to manufacturers and engineers, it was announced by The Tomkins-Johnson Co., Jackson, Mich. Regarded as a valuable reference and time-saver for engineers, this catalog should enable the customer to determine the exact cylinder required for a particular job of



pneumatic power movement in his plant. Thus, by consulting the specification charts in the catalog, cylinders of the exact size and capacity needed can be ordered without loss of time in correspondence, telephoning, etc.

Blueprints and specifications are shown for 112 different air cylinders included in seven standard styles and also double end rod type cylinders. **151-C**

(Continued on Page 152)

(Continued from Page 151)

ACCURACY IN SMALL LOT PRODUCTION—without jigs is provided by the attached compound table—a special feature on Super Service Upright Drills, manufactured by the Cincinnati Bickford Tool Co., Dept. T, Oakley, Cincinnati, O. These Upright Drills include such features as productive capacity, adaptability, reliability, accuracy, convenience and economy to give you "more holes per dollar." Complete information is contained in Booklet U-25. **153-C**

THE FASTEST THING IN FASTENINGS—is discussed in a 20-page bulletin issued by Tinnerman Products, Inc., Dept. T, Cleveland, O., manufacturers of Speed Nuts for Aircraft, according to U. S. Army Air Force Specifications. This bulletin contains important information on speeding up the assembly of aircraft and other war equipment. **76-C**

AMEs
UPRIGHT GAUGE No. 13
The model best suited for general testing and measuring in thousandths inches or less. Base is 8 inches square. Capacity for measuring to 6 inches. Weight 17 pounds.
Price
$30.00
B. C. AMES CO. Waltham, Mass.

MASSIVE AND RIGID IN CONSTRUCTION—and weighing far more than the average plate of similar size, Barco surface plates have an extra thickness at the top which allows for replaning and rescraping if necessary. These plates, made of Meehanite, are discussed in an attractive 4-page leaflet issued by Barco Scraping Co., 1980 E. 65th St., Cleveland, O. **154-C**

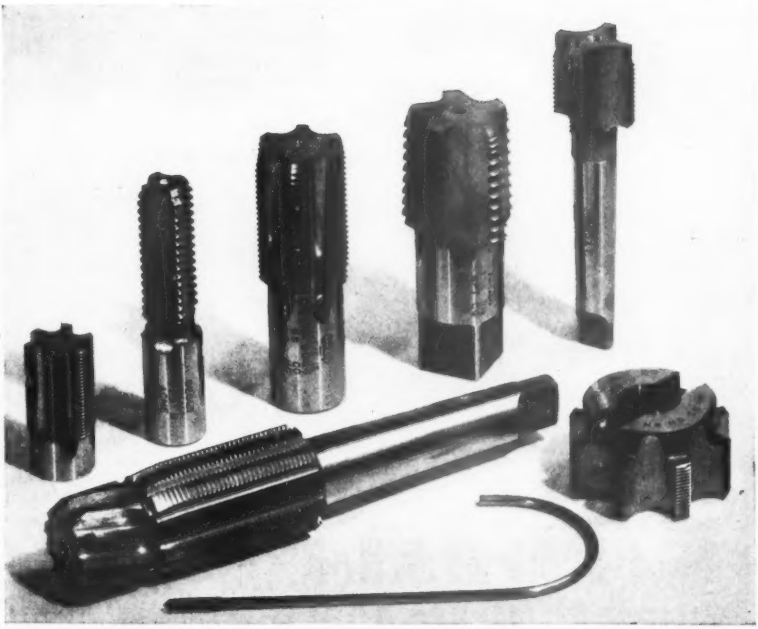
THE DELAWARE CONTROLLED ATMOSPHERE FURNACE—built on modern lines to meet the most exacting demands of the plant engineer, metallurgist and heat treater, is the answer, it is claimed to the heat-treating problem on all types of steel. Fuel economy, low upkeep cost, uniformity of hearth and thermocouple temperature, and simplified atmosphere control for steels hardening at temperatures above 1700° F, including the more difficult high carbon high chrome and molybdenum high speed steels, are a few of its distinguishing features. All these interesting facts and more, including illustrations and specifications, are contained in a 15-page booklet issued by the Delaware Tool Steel Corp., Dept. J, Wilmington, Del. **155-C**

FAST - ACCURATE - RUGGED—describes Wells metal cutting band saws as presented in an 8-page bulletin released by the Wells Mfg. Corp., Dept. T, Three Rivers, Mich. Special, Foundry, Tool Room, Production and Heavy Duty Saws are clearly described and illustrated along with a list of specifications for each. Neat in appearance and easy to sweep around is their saw stock stand which is a real labor saving device. It has an adjustable head from 24" to 28" and takes any width of material. This stock stand is not only of use on the Wells Machine, but also on any other Cut Off, Hack or Band Saw now on the market which has a bed that is less than 28" from the floor. **156-C**

(Cont'd on Page 154)

BESLY

TAPS ARE TOPS



Besly Taps are good Taps. Every step of our manufacturing process is closely watched to the end that taps bearing the name "Besly" do perform as they should. When you think of tapping remember Besly Taps are "tops".

Send for CATALOG No. 67

It has a wealth of useful information for Tap users

CHARLES H. BESLY & COMPANY

118-124 NORTH CLINTON ST., CHICAGO, ILLINOIS

FACTORY: BELOIT, WISCONSIN

(Continued from Page 152)

A NEW HIGH in metal sawing efficiency is the new Atkins Curled Chip System as described in an attractively illustrated booklet released by E. C. Atkins & Co., 408 S. Illinois St., Indianapolis, Ind. An enlarged view of the Atkins-Curled Chip Milling Saw illustrates its pronounced strength to withstand the heavy feeds and speeds now attainable with these new saws. This booklet is full of excellent illustrations, diagrams, charts and specifications well worth reading. **157-C**

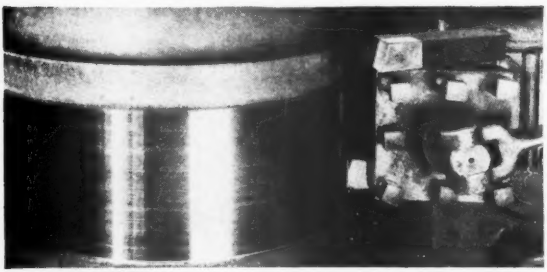
PRODUCTION TOOLS BY PRODUCTION MEN—for today's production problems are discussed and illustrated in Catalog No. 4, issued by Products Engineering Co., Dept. D, Los Angeles, Calif. Excellent application photographs show a few ways the major aircraft companies employ PEC clamps. These clamps can be used to solve most any clamping problem you may have on jigs and fixtures or any place where quick acting clamps are desired. Photographs, diagrams and specifications effectively describe the tools presented. **158-C**

DIFFERENT MODELS—of Centrifugal Coolant Pumps are described and illustrated in a series of leaflets distributed by Floyd Penrod & Sons Tool & Engineering Co., Dept. J, 1208-1216 W. 2nd St., Muncie, Ind. Models P-20 (vertical bracket), P-10 (horizontal), and P-30 (vertical) Pumps can be easily applied to milling machines, lathes, drill presses, screw machines, etc., or any other metal cutting machine where cutting tools should be saved and production increased. Diagrams, specifications and price lists are included in their description. **159-C**

A BIG VISE FOR THE BIG JOBS—built by "experience" is the Rousselle Victory Vise. It is streamlined, balanced, improved and provides a stronger and more accurate method of holding work for milling, grinding, cutting and other similar operations. One of its greatest advantages is the tremendous saving in set-up time. With complete graduations around the entire dial on the broad plainly visible Swivel Base Dial the operator can quickly, easily and accurately set the vise at any degree. More complete information is contained in a catalog issued by David J. Ross Co., Dept. TD-9, Benton Harbor, Mich. **160-C**

"YOUR GUIDE TO FASTER, BETTER MARKING"—Noblewest Catalog Supplement No. 43 by the Noble & Westbrook Mfg. Co., E. Hartford, Conn., shows a variety of different Noblewest marking machines. Highlighted is the ease of operation, permitting the utilization of women operators. **161-C**

(Cont'd on Page 156)



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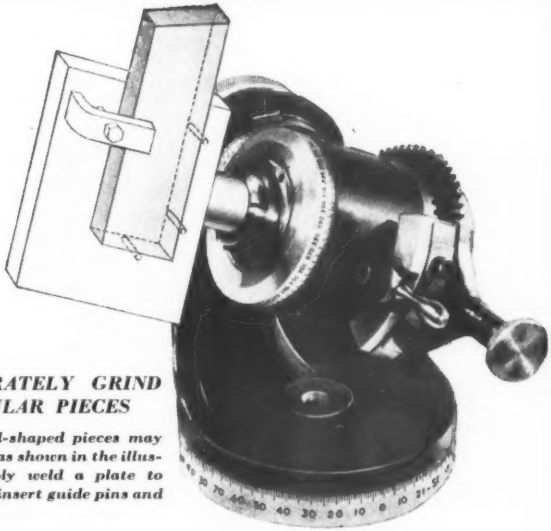
SOLID AND TIPPED TOOLS

● CROBALT solid and tipped tools are available in standard and special shapes and sizes. Whatever your operation—turning, facing, boring or milling—CROBALT superior cutting tools will provide longer tool life, maximum machine output and long-run economy. CROBALT maintains a staff of engineers to assist you.

Write for catalog and prices.

CROBALT INC.
ANN ARBOR, MICH.



TO ACCURATELY GRIND IRREGULAR PIECES

Square or odd-shaped pieces may easily be held as shown in the illustration. Simply weld a plate to round shank, insert guide pins and clamp firmly.

You'll find 101 USES for this UNIVERSAL PRECISION INDEXING HEAD

All of your regular tools will fit the standard No. 4 Morse, straight shank Hardinge collets or, with a conversion sleeve (extra), No. 9 B. & S. without the use of a special set-up as shown above. No other piece of equipment in your shop is so adaptable and versatile . . . nor more accurate. Graduated 360° in three planes, for every simple or compound angle. Can be used on any tool or surface grinder. Prompt delivery.

Write for illustrated circular.

CLEVELAND

TOOL ENGINEERING COMPANY

9105 DETROIT AVE. • CLEVELAND, OHIO

(Continued from Page 154)

THE KEY TO AUTOMATIC FINISHING—shown photographically, gives various combina-

tions of relatively standard units of Hammond Rotary Table Automatics and their extreme flexibility in adjustment of heads, table speeds and work holding chucks. This flexibility makes them adaptable to a wide variety of parts to be deburred, brushed, polished or buffed. Construction features are clearly given and a complete table of specifications is tabulated for ready reference. Bulletin 401, Hammond Machinery Builders, Inc., 1631 Douglas Ave., Kalamazoo 54, Mich. **95-C**

IMPORTANT: BE SURE TO keep dirt out of unwrapped bearings as it is one of the principal causes of premature wear warns a 15-page catalog, issued by the Ahlberg Bearing Co., 3030 West 47th St., Chicago, Ill. Helpful suggestions on bearing installation and care are fully described. A series of photographs depict the different stages of a bearing from the time it is found that it needs replacing up through the actual stages of regrinding, final inspection, and then packaged, ready for service. **162-C**

C-F POSITIONERS
are Universal Tools
C-F Positioners cut welding time as much as 60%, reduce handling time to a fraction, assure uniform stronger, smoother welds, and greatly increase output per man.
With C-F POSITIONERS you cannot only speed-up today's war production, but will be tooled-up to meet after-the-war competition, because each C-F POSITIONER is a universal tool—is pedestal mounted to give maximum clearance from all sides, is adjustable for height, rotates 360° and tilts to 135° beyond horizontal . . . gives "a thousand different set-ups" at the push of a button or turn of a hand wheel. Six types, capacities to 30,000 pounds, manually operated, motor driven or with variable speed drive for hand or automatic welding.
Write for Bulletin WP 22
CULLEN-FRIESTEDT CO.
1214 SOUTH KILBOURN AVENUE CHICAGO, ILLINOIS

TYPICAL CUSTOMER TESTS—are shown photographically in an interesting booklet issued by The Doall Co., 1203 Thacker St., Des Plaines, Ill. Doall maintains its own modern laboratory to solve unusual cutting problems for its customers and to save valuable man hours and materials on the Nation's Production Lines. Helpful suggestions are given on how to get the best performance from Doall saws. Constant specialization in handling a wide variety of sawing jobs enabled them to develop and improve narrow metal cutting Doall Band Saws now available in sizes as small as ⅛" and $\frac{3}{16}$" wide. They are standardized at 0.025" thick, and have the back edge of the band annealed. The hardness extends only to the base of the teeth, which cannot be re-set or re-sharpened. **130-C**

SAVE TIME AND MONEY THESE 5 DIFFERENT WAYS

This small compact electric furnace is inexpensive, handy and easy to operate—ideal for small tool and die shops—saves time these five different ways:

1. Eliminates delays in sending small machine parts out to overcrowded commercial heat treaters.
2. Saves time and expense of drawing or tempering small metal parts in large furnaces.
3. Cuts handling time when normalizing or annealing small parts. No waiting.
4. Conveniently available for pre-heating for subsequent high-speed hardening.
5. Eliminates shut downs and delays in servicing emergency repair orders.

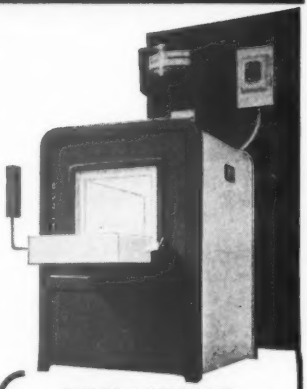
AVAILABLE IN TWO SIZES

Type	*Chamber Capacity*	*Amps 115 V*	*Watts*	*Amps 230 V*	*Price*
MH-3	8"W 6"H 14"L	29.6	3400	14.8	$124.00*
MH-4	10"W 6"H 18"L	....	4800	20.9	$191.00*

**Includes Hearth Plate*

MAX. SAFE TEMPERATURE—Continuous operation, 1750° F.; Intermittent operation, 1850° F.

AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire complete—$152.40.

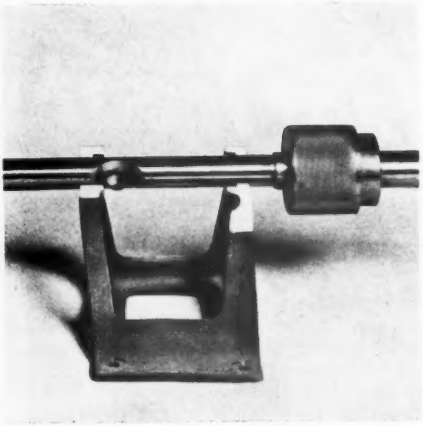


REPLACEABLE HEATING ELEMENTS

Replaceable nickel chromium resistors embedded in rectangular refractory blocks. Elements form inner walls of furnace chamber, and may be replaced easily and quickly after removing rear panel — furnace structure remains undisturbed.

FREE—Complete data covering specifications, additional applications and ordering instructions are included in this new folder. Write for your copy today. Ask for Bulletin No. 50.

COOLEY ELECTRIC MANUFACTURING CORP.
215 S. SENATE AVENUE • INDIANAPOLIS, IND.



New Tool Removes Burrs in One Quick Operation

WITH the aid of the new Nobur burr-removing Tool, a burring operation that formerly took 15-20 minutes for each part can now be done in 45 seconds, announces the Nobur Manufacturing Co., Los Angeles, Calif. This extremely simple and efficient tool removes the burrs or sharp projections in one easy, double-quick operation.

Production requirements for one of Southern California's aircraft companies demanded that all aileron pulley brackets be completely free of all burrs and sharp edges. This necessitated the use of small hooked hand scrapers that were inserted from the outer side in order to remove the burrs on the inner edges. As a slow hand operation, this job took 20 minutes for the average worker to do. The illustration shows how the same job is now done with the Nobur Tool.

It has a special blade ground for a two-step diameter, burring the outer face and inner shoulder of the ball-bearing seat simultaneously. Twenty-five parts are now finished in the time formerly used to finish just one part and there is a great improvement in the quality of the finished work, more uniformly smooth edges are obtained and the saving in time is considerable.

The Nobur burr-removing tool can be handled on any machine

(Cont'd on Page 160)

Parallel Surfacing with DE-STA-CO Toggle Clamps

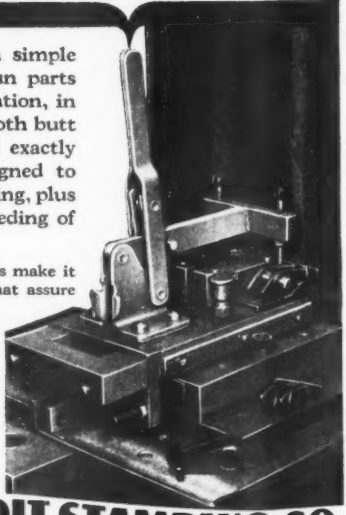
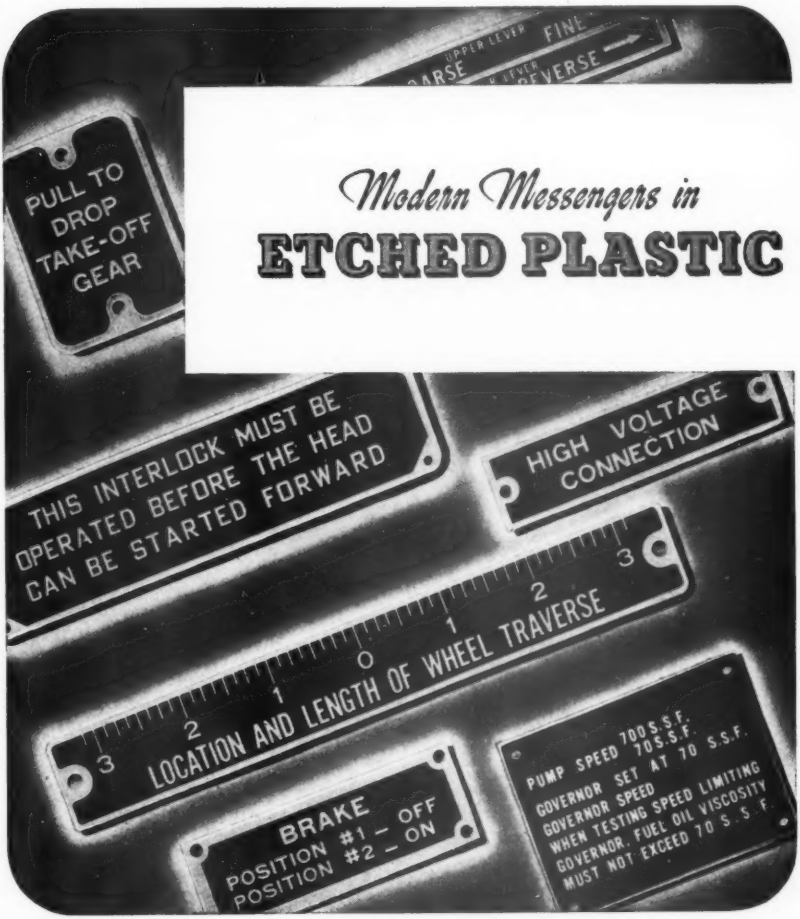


Illustration shows a simple jig clamping two gun parts for a surfacing operation, in such position that both butt surfaces are ground exactly parallel. Jig is designed to afford positive clamping, plus quick release and feeding of parts.

De-Sta-Co Toggle Clamps make it easy to build fixtures that assure accurate work and increased production. Used for clamping parts in production and assembly operations. Made in all sizes and types.

Bulletin No. 43 sent free on request.

DETROIT STAMPING CO.
Established Over 25 Years
344 Midland Ave • Detroit 3, Mich.


PULL TO DROP TAKE-OFF GEAR
THIS INTERLOCK MUST BE OPERATED BEFORE THE HEAD CAN BE STARTED FORWARD
HIGH VOLTAGE CONNECTION
LOCATION AND LENGTH OF WHEEL TRAVERSE
BRAKE
POSITION #1 — OFF
POSITION #2 — ON
PUMP SPEED 700 S.S.F.
GOVERNOR SET AT 70 S.S.F.
GOVERNOR SPEED
WHEN TESTING SPEED LIMITING
GOVERNOR, FUEL OIL VISCOSITY
MUST NOT EXCEED 70 S.S.F.

Modern Messengers in ETCHED PLASTIC

For Complete Details write

Eastern Etching & Mfg. Co.

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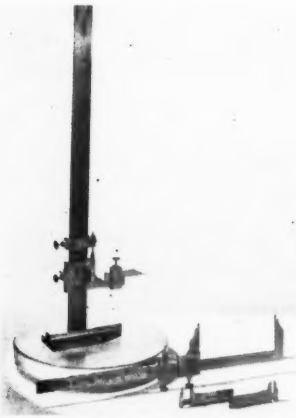
Etched Plastic instruction plates, rating plates, speed and feed plates, dials, scales, employee checks are releasing tons of metal for the tough jobs.

Easy to read, easy to clean, permanent *etched plastic* can be stamped or serially numbered with the same equipment formerly used on metal plates.

LASTING • LEGIBLE • ATTRACTIVE • INEXPENSIVE



Vernier Height Gage for Accurate Layout Work

ONE of the latest additions to the new McGrath St. Paul line of precision tools is an 18" vernier height gage.

This tool has all working surfaces lapped to five wave lengths of flat and is designed for accurate layout work. It is already being used very successfully in a large number of aircraft construction and maintenance plants. This vernier height gage is also available in 10", 24" and 36" sizes.

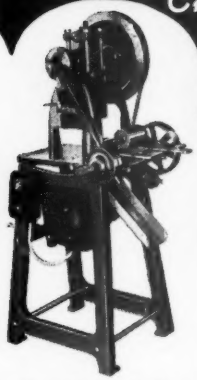
Other McGrath St. Paul products are 8", 12" and 24" vernier calipers for measuring both inside and outside dimensions and 3" slide calipers for quick measurements. The latter is exceptionally easy to use, requiring only one hand for operation.

This company also manufactures glass surface plates in four sizes, optically ground to within five wave lengths of flat and satin finished, insuring good contact and easy movement of the tools used. The glass in these surface plates has a low coefficient of expansion and will resist wear and keep its shape over a long period of time.

For further details, write McGrath St. Paul Co., 7th at Kittson, St. Paul, Minn. 546-C

DIEBEL Hi 550 RPM Speed STAMPING PRESS

Cuts Production Time



FROM 800 hours TO 35 hours ON SINGLE WAR-TIME ORDER

Press Pays for Itself on just ONE job!

Stamping production of small aircraft part is boosted from 400 per hour to 12,000 per hour — costs cut from $800 to $30.

[Because of war restrictions, illustration or description of part is prohibited.]

The Diebel Hi-Speed Press is the ideal machine for all small punch work. It saves power, labor, space, money.

WRITE FOR BULLETIN

SEND SAMPLES OR BLUE PRINTS — QUICK DELIVERY

DI MACHINE CORP.

DIVISION OF DIEBEL DIE & MFG. CO.

3653 N. LINCOLN AVE. CHICAGO

(Cont'd from Page 158)

with complete safety. It is available in $\frac{1}{16}$" progressive sizes—from $\frac{3}{16}$" to 1". Special sizes and special blades to solve difficult burring problems can be furnished upon request.

Nobur Manufacturing Co., 912 No. Orange Drive, Los Angeles, Calif. 164-C

SAVE PRODUCTION TIME *with a* SHOPLIFTER

One man can handle heavy dies alone. Not necessary to stop other machines to get help.

MORE production per day from your machines if a Shoplifter is handy to do the heavy job of moving dies from storage racks to the press. In these times when maximum production of machines is of vital importance, much time and labor can be saved if the operator can handle the heavy work of changing dies without calling for help from other operators.

The Shoplifter is built for this job. Dependable and safe with a rated capacity of 500 lbs. (heavier machines up to 5000 lbs. can be furnished). Entire machine built of structural steel. Electrically welded throughout. Platform lifts 54" above floor and lowers to within 5½" of floor. Overall height 72". Size of platform 24"x24" wood deck. Crank, up and down, hoist unit.

Price

$147.50

ECONOMY ENGINEERING CO.

2659 W. Van Buren St., Chicago

IMMEDIATE DELIVERY

Plastic Grip Featured in De-Sta-Co Line

A NEW "velvet grip", made of heavy extruded plastic, can be fitted over the handles of most toggle clamps in the De-Sta-Co line and is now being supplied as standard equipment by the manufacturer.

It has the appearance and physical properties of rubber; but unlike rubber, is not affected by oil or grease. This device, which extends the full length of the handle, provides a positive hand hold, plus cushioned protection for the operator's hands in both locking and releasing, regardless of whether the handle is pushed over or "kicked" over.

Especially suitable for use in aircraft constructions, or on other work where clamping space is limited, is the new, small, light duty clamp, which has recently been added to the De-Sta-Co line of toggle clamps.

This new De-Sta-Co clamp measures only 5½" in height overall and has a base, 1⅜" by 1¾". The length of the bar from the handle to tip is 2¼". The two styles available are model 207S with solid straight bar, and model 207U with "U" shape bar.

Descriptive literature will be sent on request by the Detroit Stamping Co., 344 Midland Ave., Detroit, Mich. 165-C

HIGH SPEED
Precision
DIE WORK, JIG AND MODEL MAKING, METAL PATTERNS, DRILLING, MILLING, REAMING, JIG BORING

LINLEY

. . . The machine that "can take it" . . . and do it. **From every point of view . . . compactness, rigidity, accuracy, speed and versatility, the Linley Milling and Jig Boring machine can be the busiest unit in a busy toolroom. Eight spindle speeds from which to choose, direct micrometer setting to eliminate pencil figuring errors, counterbalanced quill to remove backlash . . . and a large capacity for such a small (18½" x 20" floor space) machine.**

You'll want full details . . . write today.

LINLEY BROTHERS COMPANY
662 State St. Extension
BRIDGEPORT, CONN.

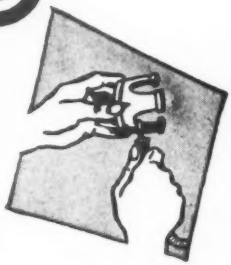
Foredom FLEXIBLE SHAFT MACHINES can serve you 3 ways!

1

For maintenance and emergency needs such as touching up production set-ups without disassembly, removing high spots on gears, identification marking of products and equipment, etc.

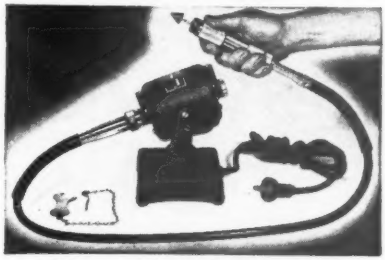
2

In die and tool departments, for grinding, finishing and touching-up dies, molds, jigs, etc.



3

For de-burring, grinding, finishing, polishing and other light production jobs — particularly valuable on irregularly-shaped parts.



Bench and suspension models available. FOUR types of handpieces, including pencil size.

No matter what kind of equipment you have — no matter what type of work you do — Foredoms can boost your production! Ford, General Motors, Bendix, Westinghouse, Warner, Allis-Chalmers, Remington Rand, Curtiss-Wright and many other leading war plants are equipped with Foredom Flexible Shaft Machines! Foredoms eliminate many types of old-fashioned, time-consuming hand work and thus speed up production. Foredoms are just as ready to "pinch hit" in emergency breakdowns. Models from $17.50 to $48.75.

Our catalog No. 418, just off the press, shows the many uses of Foredom Flexible Shaft Machines in many different kinds of industries. Find out how a Foredom can help solve today's production and maintenance problems in your plant. Send for this catalog today.

Just attach coupon to your letterhead

Foredom

FLEXIBLE SHAFT MACHINES

SOLVE MANY PRODUCTION AND MAINTENANCE PROBLEMS

FOREDOM ELECTRIC CO. 27 PARK PLACE, NEW YORK CITY

Foredom Electric Company,
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Please send us your new catalog No. 418 showing the different uses of Foredom Flexible Shaft Machines.

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State .....

Driller Interchangeable with Conventional Chuck

A NEW device known as the Rego Karweit Driller, which is interchangeable with the conventional chuck, has been found to greatly increase production while using standard drilling machines. In drilling unusually deep holes in some materials, drilling time may be reduced to about one-half the time required in conventional practice. Under this new method, however, cutting speeds may be increased as much as 25% above handbook ratings, if desired, thus effecting a large additional increase in production.

Holes as deep as 20 times the drill diameter can be drilled by unskilled operators or with automatic feeds, without removing the drill from the holes. Some users report hole sizes and alignment sufficiently true and wall finish sufficiently smooth, thus making reaming unnecessary.

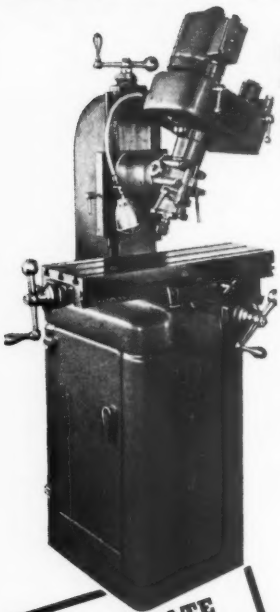
The Rego Karweit Driller produces automatically at the cutting edges of the drill, small uniform chips which clear the drill flutes easily, instead of long, whipping spirals which score the side walls of the holes and sometimes injure operators. Surplus coolant or lubricant washes the chips away and the lubricant serves as a coolant to bathe both sides of the cutting edges of the drill at every revolution. This keeps the drill much cooler than is possible when conventional drilling equipment is used and greatly lengthens its life.

The Bastian-Blessing Co., 4208 Peterson Ave., Chicago 30, Ill. 166-C

HOLLAND MILLER

With

SWIVEL HEAD



This rigid and versatile miller answers the need for a flexible toolroom and production machine with an unusually wide range of speeds. Note these exclusive features:

- Controls of table and head are all reached conveniently from the operator's seat.
- Rigid table mounting at permanent height provides extra stability and accuracy.
- Swivel Head, with motor centered above spindle, has 8" travel and 3" quill feed.
- A wide range of speeds, 200-4375 RPM, with standard motor, or 1/3 less with slow speed motor, is offered for boring and high-speed milling.

Write TODAY for complete specifications and descriptive details.

IMMEDIATE DELIVERY

J. W. HOLLAND CO.

Box 107

Fitchburg ● Mass.

Announcing Two Revolutionary Inventions . . .

SpeediChuk
WITH THE Precision **BREN COLLET**

Increases 1/2" Collet Capacity Lathes to 3/4"

- **Fits ATLAS, LOGAN, SOUTH BEND, CLAUSING Lathes and others with a 1½" x 8 Thread Spindle Nose having a No. 3 Morse Taper on inside**

NOW when collet work on round stock up to ¾" is indicated, use SPEEDICHUK and the uniquely designed BREN Collet in your small lathes . . . *Free the heavier machine tools for other war duties.* Easily installed, SPEEDICHUK requires no adapter plate. It is the only collet chuck using a floating closing sleeve which compensates for wear and misalignment of the lathe spindle. The BREN Collet utilizes maximum spindle accuracy for the first time by combining tapered closing sleeve on body of the collet.

Immediate Delivery From Stock

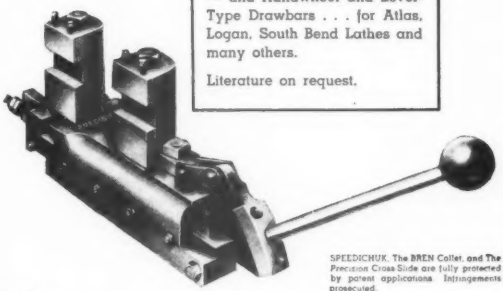
THE NEW Precision LEVER TYPE CROSS-SLIDE

- **Equipped with sensational tool leveling adjustment — Maintains tool in absolutely horizontal position.**

A sturdily constructed job, the *Precision* Lever Type CROSS-SLIDE has a capacity of 2½". Built into it are many important features not usually found in a single unit . . . Three separate models fitting ATLAS, LOGAN, 9" SOUTH BEND Lathes. Can also be adjusted to any other bench lathes.

Your dealer can supply you with the new *Precision* lathe attachments. Also ask him for *Precision* Collet Models 3AT, 3C, 5C, 480 (Same as W. & S. No. 1) — and Handwheel and Lever-Type Drawbars . . . for Atlas, Logan, South Bend Lathes and many others.

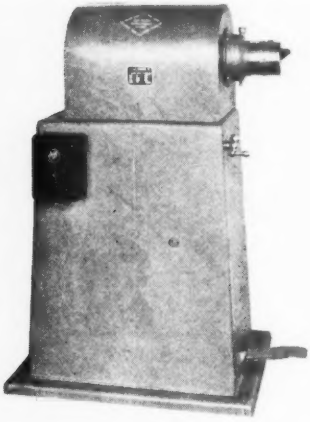
Literature on request.



Precision Collets and Drawbars

SPEEDICHUK, The BREN Collet, and The *Precision* Cross-Slide are fully protected by patent applications. Infringements prosecuted.

GENERAL DIE - STAMPING - TOOL COMPANY
PRECISION COLLET DIVISION, 265 Canal Street, New York 13, N. Y.



New, Versatile Speed Lathe by Schauer

THE new Schauer Ideal Variable Speed Lathe provides an efficient method of lapping and finishing metal or plastic parts at a low speed of 100 rpm to a high speed of 4800 rpm. It is especially effective on final finishing operations of heavier work that requires burring, filing, polishing and lapping of gages, gears, pinions and pulleys.

The variable speed of the VA3B-C is obtained through a Reeves Drive which is operated by stronger, more durable pulley belts that are made to withstand the strain of shifting the infinitely variable speeds. An improved twin disc clutch assembly transmits the power from a continuously running motor to the spindle of the Speed Lathe when the foot treadle is depressed. When the foot treadle is released, a "disc type" brake is automatically applied. Selection of the variable speeds is obtained by the balcrank handle conveniently located on the side of the machine. The variable speed ratio is 6 to 1 for a one speed motor and 12 to 1 for a two speed motor. Operation of the machine is by means of the new, improved, "non-slip" foot treadle.

A separate welded steel housing, mounted on a rigid, heavy, welded steel floor type pedestal, contains the spindle and holding devices. This lathe does not vibrate with heavy work at high speeds and its motor is easily accessible for replacement or removal.

Write to Schauer Machine Co., 2076 Reading Rd., Cincinnati, O. 129-C

ARE YOU
CLEAN OIL CONSCIOUS
DO YOU KNOW that it is possible to completely remove all abrasives, dirt and contamination from oils and coolants used in cutting, grinding, honing, thread cutting and similar operations?
Do you know that the removal of this contamination will increase production, lower costs and remove all danger of Dermatitis?
Honan-Crane Oil Purification equipment will continuously remove these contaminants as fast as they are liberated and your machines operate at all times on clean fresh oil.
The complete, continuous removal of this contamination will:
1. Allow better finish of products
2. Lengthen tool life
3. Reduce time lost in grinding tools and dressing stones
4. Cut rejections to a minimum
5. Prevent loaded stones from affecting final finishes
6. Prevent Dermatitis
7. Safely extend life of oil or coolant
Write for complete information on any type of oil.
Honan-Crane
801 WABASH AVE.
LEBANON, INDIANA

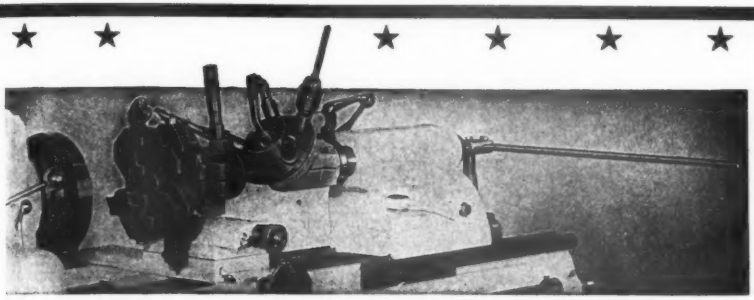
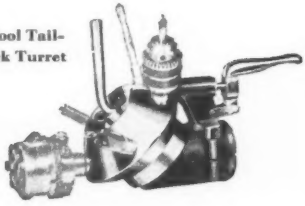


Photo above shows Jefferson Turrets on 16" lathe

Convert YOUR ENGINE LATHE INTO A TURRET LATHE IN 15 SECONDS

5-Tool Tail-Stock Turret

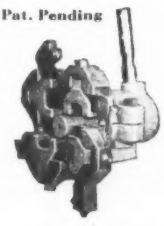


Yes, it's as easy as that! You simply attach the Jefferson Tail-Stock Turret, the Jefferson Tool-Post Turret, and the Jefferson Adjustable Pull Feed to your lathes as shown in illustration, above.

The productive capacity of these machines will be more than doubled in many instances because there will be available at all times NINE DIFFERENT TOOLS.

With these three JEFFERSON time-saving devices attached to a lathe, any kind of work may be done, such as forming, roughing, boring, finishing, knurling, drilling, tapping, etc., without stopping the lathe, or changing tools. THE JEFFERSON TURRETS are made very substantial, rigid, accurate and in several sizes to fit small bench lathes up to 24" swing.

Pat. Pending



4-Tool Tool-Post Turret

We also Manufacture the Jefferson Bull Dog Precision Milling Machine. Obtainable Power or Hand Feed.

Delivery 3 weeks.

Jefferson Turrets are real production tools — substantial, rigid, accurate and adaptable to any size or make of engine lathes. They must not be confused with the small makeshift gadgets now on the market.

TURRET DELIVERIES IN 6 DAYS

Write for further details of these and other Jefferson time-saving machine tools and machinery.

JEFFERSON MACHINE TOOL CO.
710 N. Fourth St., Cincinnati, Ohio

Tool-Post Turrets, Tail-Stock Turrets, Adjustable Pull Feeds, Belt Sanders, Gyratory Foundry Riddles, Overhead Swing Frame Grinders, Milling Machines, Dividing Heads and Vises.

Odd Shapes Quickly and Accurately Produced

A SIMPLE, inexpensive, automatic profiler that produces oddly-shaped parts quickly and accurately is now being manufactured by the E. A. Thompson Manufacturing Co., Ferndale, Mich.

This machine's ability to mill to close limits is attributed to the simple, direct control of pieces being machined and the accuracy and rigidity built into the machine itself, thus eliminating the penalty usually incurred when irregularly contoured parts are needed.

The head of the machine carries the cutter spindle within the quill which has a silent chain drive and hardened helical change gears running in oil. The head is adjustable to .001" in positioning for work.

A 14" hydraulically controlled, rotating table carries the work and a ground center hole in the table facilitates the position of work holding fixtures. Spindle and table are independently driven and controlled.

The entire machine is automatic with the exception of loading and unloading, and these operations, however, require no machine stoppage.

Some of the other important features of this Thompson machine are: complete automatic control of feed and traverse, spindle quill lock, spindle drive clutch, brake and work table stop and a pressure and gravity built-in lubrication system. All working parts are enclosed, insuring safety and protection from dirt and chips.

E. A. Thompson Mfg. Co., 1309 Hilton Rd., Ferndale, Mich. 167-C

Wings across the Sea...

HEAT TREATED BY LAKESIDE!

Our Services

Flame Hardening · Annealing · Aerocasing · Bar Stock Treating and Straightening · Heat Treating · Pack or Gas Carburizing · Sand Blasting · Chapmanizing · Tempering · Cyaniding · Nitriding · Hi-Speed Hardening

MSI METAL TREATING INSTITUTE

THE LAKESIDE STEEL IMPROVEMENT CO.

5418 Lakeside Avenue CLEVELAND, OHIO Phone Henderson 9100

American No. 2
PLAIN MILLING MACHINE

for
SPEED, ACCURACY AND VERSATILITY
in
ARMAMENT PRODUCTION

Infinite Spindle Speeds—25 to 500 r. p. m.

Standardized Spindle Nose. Spindle heat-treated chrome-nickel steel with No. 40 taper.

Motor in Base Drive. 3 hp U. S. Vari-Drive motor. Twin-Disc Duplex Machine Tool Clutch.

Heavy Rugged Construction. Heavily proportioned column houses motor drive and power shafts.

PROMPT DELIVERY

Spindle is heat-treated chrome-nickel steel and runs in heavy phosphor bronze bearings compensated for wear and equipped with alemite lubrication fittings. Standardized flange spindle nose has No. 40 taper.
Controls for speed and feed are centrally located for ease of operation.

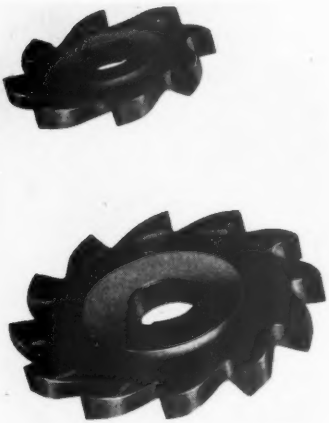
Table working surface	46" x 10¼"
Longitudinal power feed	25"
Transverse power feed	9"
Vertical hand feed	19"
Max. distance spindle to table	19"
Number of geared feeds	16"
Range per spindle revolution	.005" to .212"

WRITE FOR FOLDER

UNIVERSAL MODEL ALSO AVAILABLE

J. L. LUCAS & SON, INC.

BRIDGEPORT, CONNECTICUT



Aircraft Parts Production Increased 300% with New Milling Cutter

A NEW carbide tipped milling cutter with cast alloy body, manufactured by Super Tool Company, has recently proved its value by a production increase of 300% in milling aircraft landing gear parts. Simplicity of construction has reduced the price of this milling cutter to a point where it can be used generally on short runs and for general shop tooling.

This tool operates at greater speeds, leading to increased table feeds, thus obtaining finishes comparable to ground surfaces and a higher degree of accuracy. The feed per tooth being lowered, the cutting pressure is lessened and there is consequently less distortion of the work. Another advantage is the throwing off of the major portion of the heat in the chip, leaving less to be absorbed by the work and the cutter.

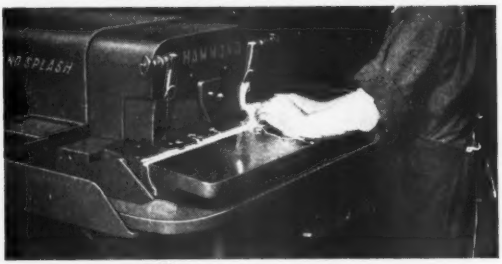
On actual production jobs, many of these new cutters are being used successfully in steel at surface speeds of 400 to 600 fpm with tooth load varying with the hardness of the steel from .0005" to .0025". Hard materials that ordinarily cannot be machined with high speed cutters can be worked efficiently with this tool.

Standard cutters for cutting cast iron, brass, bronze, copper, aluminum, magnesium and plastics are supplied in diameters from 3" to 8" in a variety of widths.

Super Tool Company, 21640 Hoover Rd., Detroit, Mich., has available a folder. 168-C

New! Hammond WET TOOL GRINDERS

FOR CARBIDE AND HIGH SPEED, TOO



LOOK! Hammond's NEW 10" and 14"

Provide many improvements over previous models: cup wheel safety discs — free flowing, fully adjustable coolant spouts — and splash pans. Under all conditions No spray-No splash grinding is assured.

"You're dry when you grind wet!"

Hammond Machinery Builders INC.

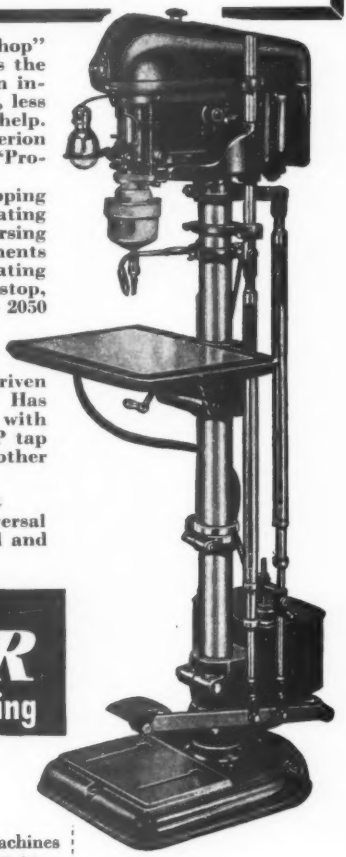
KALAMAZOO 54, MICHIGAN

WRITE FOR BULLETIN 204

1631 DOUGLAS AVENUE

Eastern Branch: 71 West 23rd St., New York 10, N. Y.

Why Shop Men Prefer These Tapping Machines



In thousands of plants, the men "out in the shop" have watched Procunier Tapping Machines pass the toughest production line tests. They have seen increased tapping output, more accurate tapping, less tap breakage — *even with green,* inexperienced help. To these men, production results are the only criterion — and for that reason they will recommend "Procunier for tapping".

The definite reasons for Procunier Superior tapping performance include: Extra long compensating springs which assure uniform tapping and reversing pressure independent of operator; all adjustments can be made quickly and easily — such as regulating compensating spring pressure, setting depth stop, changing to any of the four speeds from 390 to 2050 RPM or adjusting timing or flow of tap lubricant. Tap establishes its own lead for greater accuracy. Automatic tap lubricator provides abundant supply exactly when needed. Motor-driven continuous flow lubricant pumps also available. Has exclusive Procunier high-speed tapping head with smooth, sensitive friction clutch and TRU-GRIP tap holder which has many advantages. Many other features.

Prompt Delivery—Send for Bulletin
giving full details and prices on Procunier Universal Tapping Machines, High Speed Tapping Head and Tru-Grip Tap Holder.

PROCUNIER
For Faster, More Accurate Tapping

Procunier Safety Chuck Co.
12-14 S. Clinton St., Chicago, Ill.

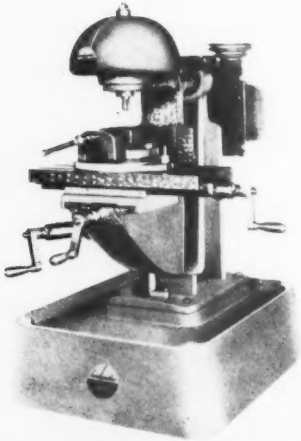
Send me bulletin on: ☐ Universal Tapping Machines ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holder.

Name.....

Address.....

City.....State.....

MAIL THIS COUPON TODAY!



Small Machine Does Big Job

COMPACTLY designed to do a big job in a small space is an improved vertical bench milling machine with a quick-change attachment for horizontal milling announced by the Benchmaster Tool Co.

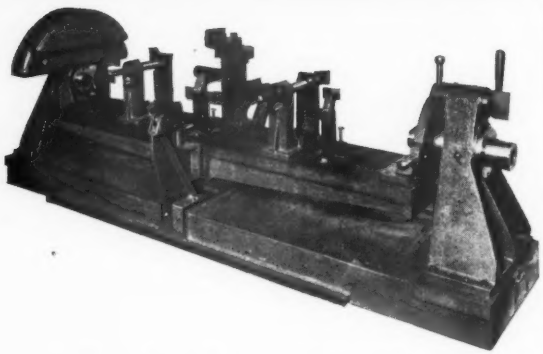
The 2½" diameter arm supporting the spindle head is clamped rigidly to the column and can be readily adjusted to rotate the spindle 60° either side of center. Or, the entire head can be easily removed and replaced with an enclosed horizontal milling attachment. Thus, a variety of jobs such as precision die making, die sinking, profiling, jig boring, key slotting, etc., can be handled without tying up a large machine.

This two-way machine stands 30" high and has a precision ground table, 6" x 14", with three T slots, ⅜", and 2" centers. Micrometer adjustments for the table movements are operated by convenient splined disengageable hand cranks, while graduated dials reading in thousandths of an inch make resetting a simple process.

Proper tension on the V-belt at all times is assured by a floating motor mount and rapid changes of the four spindle speeds (450, 850, 1400 and 2100 rpm) are thus possible without the use of tools. The spindle has a No. 2 Morse Taper and the milling machine is powered with a ⅓ HP motor.

Complete details can be obtained from The Benchmaster Tool Co., (formerly Duro Mfg. Co. of Los Angeles) 2958 West Pico, Los Angeles, Calif. 169-C

We Sell Precision . .



★ Dies, Jigs, Fixtures, Special Machinery and Designing.

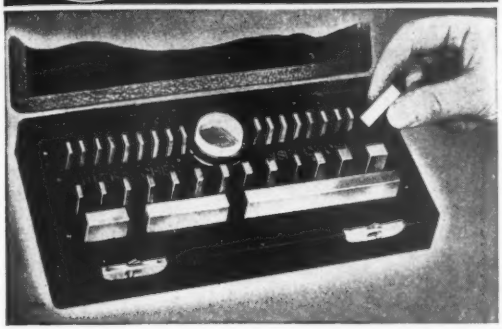
Hardened and Ground Parts to Order.

MASTER MACHINE & TOOL COMPANY

925 WEST NORTH AVENUE, CHICAGO, ILL.

ACCURACY

Ultra-Chex



Gage Blocks Accurate to .000008"

Specialization in one 34 block unit enables us to offer the ULTRA-CHEX Inspectoset for $125.00 including optical flat for checking lapped surfaces.

Ultra-Chex are indispensable for precision manufacture. They provide a shop with an absolutely reliable system of size control, a necessity wherever definite limits of accuracy must be maintained. Hundreds of prime and sub-contractors now guarantee the accuracy of their output by using ULTRA-CHEX.

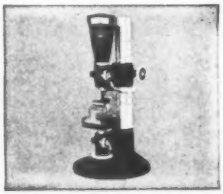
The 34 blocks in the Inspectoset are as follows:

.1001", .1002", .1003", .1004", .1005", .1006", .1007", .1008", .1009", .101", .102", .103", .104", .105", .106", .107", .108", .109", .110", .120", .130", .140", .150", .160", .170", .180", .190", .100", .200", .300", .500", 1.000", 2.000", 4.000".

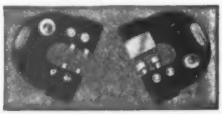
← *Checking lead accuracy of a micrometer with Ultra-Chex.*

Write for 8 page bulletin describing fully the many uses you will have for Ultra-Chex in your shop.

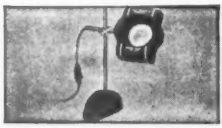
Request also folder on Reed Micrometers.



SCHERR COMPARITOL—for checking gage blocks, gages and work for size, accuracy and wear. $195.00



ATLANTIC ADJUSTABLE LIMIT SNAP GAGES—for accurate check-up, without having to depend on operator's skill. Sizes to 6".

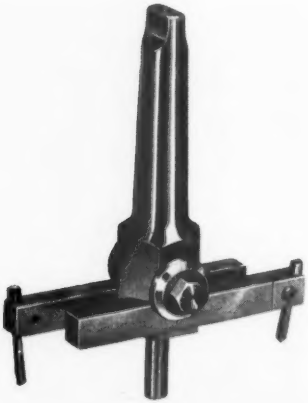


MAGNI-RAY—a wide field illuminated magnifier for close inspection of work and operations. $18.50 List.

SPENCER BINOCULARS — for detecting surface finish, imperfections, etc., by means of 3-dimensional vision. $143.50.

WILDER PROJECTOR provides accurate measuring or comparison of objects by means of magnified shadow.

GEORGE SCHERR COMPANY, INC. 128-B LAFAYETTE ST., NEW YORK, N. Y.



Unique Blade Arrangement in Tool Cutter

AMONG the many difficult operations which have been successfully handled by the Robert H. Clark Company's new Fly Cutter is that of cutting washers and gaskets from "live" rubber and other hard-to-work substances. This new Fly Cutter is desirable for cutting holes or discs in metals of thicknesses up to 1", including boiler plate, stainless steel, cast iron, plastics, and other "problem" materials. Some important innovations have been built into this tool by the manufacturer: (1) Generous clearance between work and the body of this Fly Cutter makes possible deeper cuts with less strain on the tool; (2) The new cutting technique eliminates chatter and assures clean holes.

With this addition to the Clark Adjustable Hole Cutter line, the manufacturers have provided tools for cutting holes from ⅝" to 10" in diameter and straight side discs from 4" to 10" in diameter.

The Clark line also includes a new adjustable surface facing tool of special interest to shops which cannot justify maintaining a full line of expensive high-speed end mills and angle cutters.

The bits in all of these tools can be easily reground or can be replaced with new bits at comparatively small cost, thus lengthening the life of the tool indefinitely. According to the manufacturer, prompt shipments are now being made on suitable priorities.

Robert H. Clark Co., 3424 Sunset Blvd., Los Angeles 26, Calif. 92-C

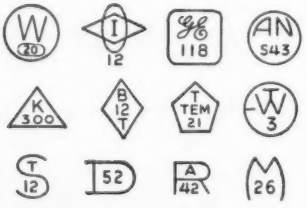
ANY DESIGN OR LETTERING

*Reproduced in "Safe-Hed"**

STEEL STAMPS

*REG. U. S. PAT. OFF.

Matthews skilled craftsmen will accurately reproduce your trade mark...symbol...monogram ... special lettering or design in sturdy built, "Safe-Hed" Steel Stamps ... for inspection marking of your products or work identification stamping. Here are a few typical examples:



Write for Bulletin A-1

This valuable bulletin illustrates hundreds of stock symbols, and ideas for special designs for inspection or work identification stamping. Write for your free copy today.

JAS. H. MATTHEWS & CO.

3896 Forbes Street Pittsburgh, Pa.

Branch Plants

New York, Boston, Chicago, Philadelphia, Newark, Syracuse

District Sales Offices

Cleveland Detroit Hartford Birmingham

SOUTH BEND LATHES

FOR CLOSE TOLERANCES
AND SMOOTH FINISH

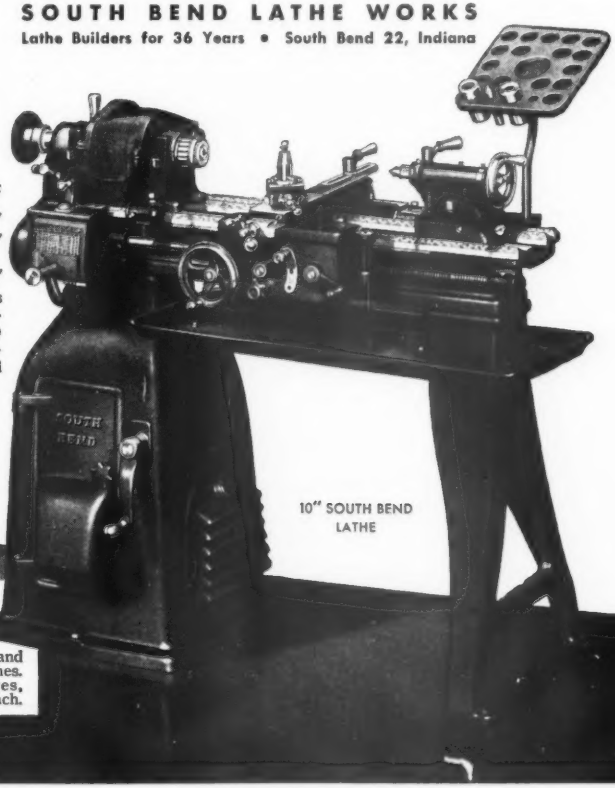
Close tolerances and smooth finishes must be maintained without sacrificing output to meet war production demands. Machine tools must have the accuracy, speed, and rigidity that make possible the efficient machining of exacting work.

These are the kinds of jobs for which South Bend Lathes are designed. The smooth operation, wide range of spindle speeds, dependable accuracy, and rigid construction of these lathes enable them to hold the tolerances and produce the finish that is required.

BUY WAR BONDS

These lathes are made in both Toolroom and Engine Lathe types with 9", 10", 13", 14½", and 16" swings, which cover a wide range of work. Also precision turret lathes. Write for a copy of Catalog 100-C in which they are all described.

SOUTH BEND LATHE WORKS
Lathe Builders for 36 Years • South Bend 22, Indiana



10" SOUTH BEND LATHE

Specifications

Swing over bed. 10⅛"
Spindle bore . . . 1⅜"
Maximum collet capacity . . . . . 1"
Thread cutting feeds (48) . 4 to 224 per in.
Spindle speeds (12) . . . 50 to 1357 r.p.m.
Power longitudinal and cross feeds . 48

"HOW TO RUN A LATHE"
A helpful handbook on operation and care of engine lathes. Contains 128 pages, 5¼"x8". Price 25c each.

Sleeve Holder Assures Clear Impressions

A NOTEWORTHY addition to the tooling industry's war program is the Safety Sleeve Holder being marketed by the M. E. Cunningham Co. of Pittsburgh, Pa. This holder was designed to assure a clear, even impression in small, round or square pieces and is said to be especially adaptable for marking gun barrels, small tubes and for numbering stock in warehouses or stock rooms.

Longer service is insured by a sturdy outside frame of alloy tool steel and the legs of the frame are grooved for use on small rounds. The type holder is held in place by a special pin, easily removed from quick change of steel type inserts, and is made of Cunningham's special "Safety" Steel to give exceptional service with the features of non-spalling and non-mushrooming.

Also included in Cunningham's line of safety wedge grip holders is the box type shell marking holder and the dual purpose box type holder. The former was designed for marking ends of hot, rough turned shells.

The dual purpose box type holder meets the specialized requirements of shell manufacturers for a device to stamp identification marks on the end and side of semi-finished 155mm shell forgings in one operation.

M. E. Cunningham Co., 104 E. Carson St., Pittsburgh 19, Pa., also offers facilities to war production manufacturers who may need assistance in solving special marking problems. 170-C

SUPPORT TO "Shangri-La"!

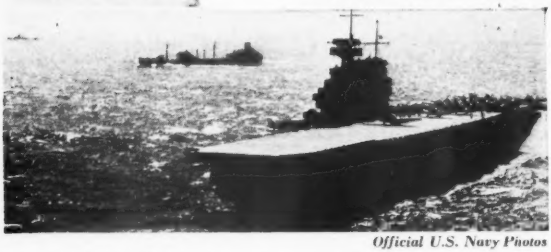
Maintaining the "eyes of the fleet" calls for constant conditioning of planes, engines and parts. In manufacture as well as maintenance, time and work savings in

FINISHING • DE-BURRING • POLISHING

are assured by Weldon Roberts

Brightboy

"The Soft Rubber Binder Cushions the Abrasive"



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Wheels, blocks, sticks, rods—for manual and machine operations. If your dealer cannot supply you with "Methods and Applications" data, catalogs and prices, write us. Our field representatives are at your service.

BRIGHTBOY INDUSTRIAL DIVISION

WELDON ROBERTS RUBBER CO., Newark, New Jersey

WELDON ROBERTS

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Tannewitz DI-SAWS

have LARGER CAPACITY, saw *Easier*, STRAIGHTER

In making inside and outside cuts on dies, tools, jigs, etc., as well as inside and outside filing and polishing, the modern die saw will save upwards of 70 per cent of the time required by ordinary methods and reduce costs proportionately. Don't overlook this great opportunity to step up both production and profits. But be sure to get the machine that gives you the added advantage of EXTRA CAPACITY (a full 24 inches between the blades) and the easier and straighter cutting that naturally follows from the use of larger wheels. Get the complete facts concerning the TANNEWITZ M-24, the most highly developed die saw on the market. Simply write for our DI-SAW Bulletin. Also describes larger DI-SAWS for special applications.

Other bulletins on request: Single and Variable Speed Foundry Band Saws; SHEET METAL CUTTING Band Saws.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN

SHOP AIDS

In requesting copies of books, please address your request directly to the designated publisher.

PRESS TOOL PRACTICE—Volumes 2 and 3 on current press tool practice deal with the work done on all classes of hand and power presses, single and double action. Part 2 treats in detail the subjects of coiling, bending, knurling, thread rolling, trimming, stamping, coining, marking methods of removing scrap off punches, metal spinning, pillar die sets for blanking, follow-on tools for single action presses, etc. Part 3 covers types of presses, setting of presses and safety. The actual production of a number of articles by means of the press from sheet or strip metal is included.

The author, P. S. Houghton, has made no attempt to include multi-stage tooling, as the idea throughout the work is to keep to simple tools which give good production with minimum trouble and experimentation. Hence the press tool layouts given are simple and comparatively cheap to make. The aim of the two volumes has been to deal with the subject in a practical way and to give as much assistance as possible to the craftsman in a small shop. Many lists of standards scattered throughout the volumes will save both time and effort. "Press Tool Practice" is published by Chapman & Hall, 11 Henrietta St., Covent Garden, London.

BY LEAVING OUT DESCRIPTIVE MATTER AND CONCENTRATING ON DATA—the large field of metals and alloys has been covered by S. L. Hoyt in considerable detail in a relatively small space in "Metals & Alloys Data Book." This compilation of reliable data on important metals and alloys for metallurgists, engineers and students is distinguished from the textbook-type of compilation in that emphasis is placed on **information,** not instruction. A few of the subjects covered include: Test Specimens; Hardness Tests; Wrought, Cast and Stainless Steels; Cast Irons and Non-Ferrous Alloys. Price, $4.75 from Reinhold Publishing Corp., 330 W. 42nd St., N. Y.

PRODUCT ENGINEERING, by Nordenholt-Kerr-Sasso, confines itself to practical design methods and procedures in use in engineering design departments. Charts and monograms pertaining to general arithmetical calculations, and tables and charts for use in the design of specific elements or structures are given. The universal problem in engineering design—selection of materials from which the various parts of the device, machine or product are to be made—and the machines themselves, are comprehensively outlined in this handbook of mechanical design Publishers, McGraw-Hill Book Co., Inc., New York, N. Y.

TOOL DESIGN AND TOOL ENGINEERING—John G. Jergens has assembled in this book a collection of articles, tables and drawings of diversified interest and value to men active in the machine tool industry. Rules and formulae for designing many of the most common details of jigs and fixtures, and examples of practical work will, in particular, be of service to the tool engineer, designer and student. Price, $2 from The Tool & Die Journal, 2460 Fairmount Blvd., Cleveland, O.

HOW TO READ A DRAWING ACCURATELY AND EFFICIENTLY is the subject of "Reading Blueprints in the Machine Industries" by Carlton Dwight. The text, complete within itself, has each instructional unit accompanied by adequate projects or questions to determine the student's understanding of the problem presented. Conformity with sound educational procedures; introduction

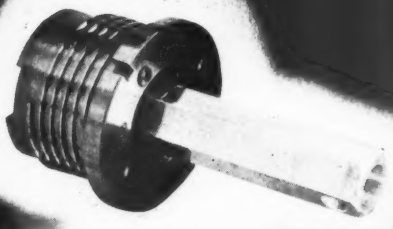
(Continued on Page 180)

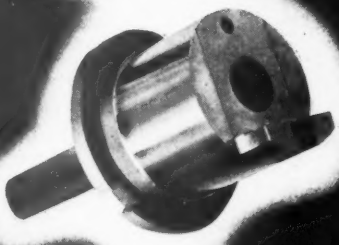
PRECISION GAGES

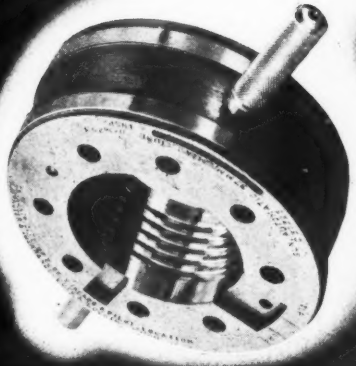
produced by skilled craftsmen assuring the finest work to meet the most rigid specifications. Our modern facilities are among the best. A complete, air-conditioned inspection laboratory enables us to build special tools and gages to your specifications, *exactly*. Send blue prints for immediate quotation and delivery schedule.

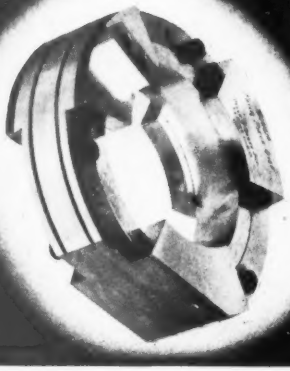
JIGS AND FIXTURES are a specialty. Prompt deliveries can be made to firms with high priorities. Work up to 24" can be made with precision accuracy.

THREAD GRINDING facilities are available to manufacturers with war orders. Write or wire today for delivery dates.









TOOLS & GAGES, INC

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ARMY E NAVY

(Continued from Page 178)

of the subject in logical, comprehensible; steps and with all subject matter, illustrations and drawings carefully scrutinized for practicability—all enable the student to interpret blueprints readily and intelligently. Available from McGraw-Hill Book Co., Inc., New York, N. Y.

PAYROLL TAX DEDUCTIONS IN A FLASH—is offered by the Deduct-O-Graph, an automatic device which shows proper payroll tax deductions for any employee when proper settings are made as to marital status, wage range and pay period. It is claimed that the device has been tested by payroll officials in comparison with the use of tables ordinarily furnished and that the Deduct-O-Graph resulted in greater speed and accuracy. When asked regarding the cost of the new device, the manufacturer, George S. May Co., 2601 N. Shore Ave., Chicago, Ill., stated that it will be furnished without cost to firms making request on business letterheads. **543-C**

RTD THREAD ROLLING HANDBOOK—is the most comprehensive discussion of thread rolling ever published, it is claimed. Its purpose is to report the progress made in the development of thread rolling; to explain the process; to describe its advantages and limitations and to suggest ways of improving operating efficiency. The information in this handbook has been drawn from the personal knowledge and research of Rolled Thread Die Co. and the experience of many screw manufacturers. Detailed drawings, a good general index and a complete section of reference tables will prove of value. The Handbook is published by Rolled Thread Die Co., Worcester, Mass. **544-C**

Industrial
DIAMOND TOOLS
The STA-KOOL Single-Point Tool is equipped with internal coolant ducts and external cooling fins to quickly dissipate the heat, thus prolonging tool life.
SMITITE Diamond Dressing Tools employ a sintered metal setting, which firmly holds the stones till they are completely consumed.
Catalogs on request
J. K. SMIT & SONS
157 Chambers St., New York, N. Y. 6400 Tireman Ave., Detroit, Mich.

THAT INCREASED TOOL LIFE—and quality of work will result by the use of a keen edge cutting tool is an admitted fact. However, there has always been an impression that increased cost in producing a higher surface finish on cutters would offset the benefits to be derived. Experimental work in a plant resulted in a practical and economical application of refined surface finish, but it was discovered that tool costs in the plant were increasing. How the Norton Co. of Worcester, Mass., checked the grinding operations for better grinding performance and their recommendations are given in a booklet, "How to Increase Tool Life." **545-C**

DEDICATED TO MILITARY AND INDUSTRIAL TECHNICIANS—whose wartime duties now include the operation of electronic devices, the purpose of the "ABC of Electronics at Work" is to give a visual explanation of the six basic ways electronic tubes function . . . to serve man's needs. Publisher Westinghouse Electric & Mfg. Co. **35-C**

No "Clock Watcher"

this TURNER UNI-DRIVE Motorizes Machine Tools

War Work

CAN'T STOP WITH THE WHISTLE!

● THE "TIME CLOCK" means nothing to the TURNER UNI-DRIVE Unit. Twelve, twenty-four or thirty-six hour shifts are mere routine for the UNI-DRIVE. Each unit operates independently of all others. It eliminates overhead pulleys and adjustments, counter shafts, ceiling vibration, belts to shift. The UNI-DRIVE provides high and low speeds on all equipment at a touch of the gear box. Increases production capacity 25% to 300%.

Some Users of TURNER UNI-DRIVE

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NOW AT WORK FOR VICTORY ★★★

The TURNER UNI-DRIVE COMPANY
(*Sales Division: Turner Machinery Co.*)
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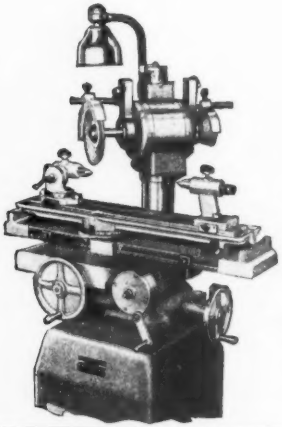
PRODUCING MACHINE TOOL DRIVES • ORDNANCE TOOLS • AIRCRAFT FITTINGS



Tool Grinders with Interchangeable Centers

THE new B600 an B602 Universal Tool Grinders, manufactured by the K. O. Lee Co. of Aberdeen, S. D., are designed by "Knock-Out" engineers to solve the every day grinding problems that confront the operator. They are extremely accurate, require minimum time expenditures in making setups, give long machine life and can be included in plant equipment at a minimum capital outlay.

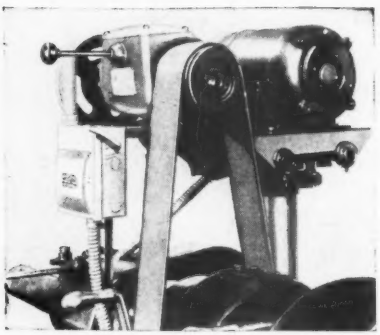
These machines have interchangeable centers, one of which is designed to hold diamond nib for dressing wheel; their motors are mounted on a full 360° swivel. The table on the B600 model is larger, with a coolant trough and wet wheel guard, and has a swivel range of 90° graduated in taper per foot and degrees.

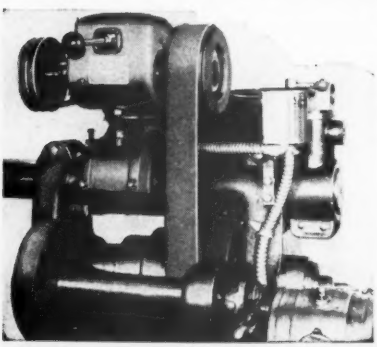
A few other distinguishing features of these grinders are: self-locking, adjustable table stops; ball bearing cross feeds; two-feed longitudinal feeds, allowing fast or slow travel; massive sturdy saddle and base.

Adjustments for wear have been built-in throughout the machines and provisions were made for easily incorporating fixtures without alteration. Some of the available fixtures are: motor driven work heads, high speed grinding fixtures, tap grinding fixtures, ball bearing work heads, radial diamond dressers and surface grinding plates. By incorporating Lee's compact motor driven work head and high speed grinding attachment, the K-O Universal Grinder becomes a competent cylindrical and internal grinder.

For further details and specifications, write the K. O. Lee Co., Dept. 9, Aberdeen, S. D. 361-C

LATHES, MILLING MACHINES





shapers, turret lathes, radial drills, slotters, etc., are motorized with WESTERN MASTER (1-5 h.p.) Transmissions with bracket . . . . . $95 WESTERN MAJOR (5-10 h. p.) Transmissions with bracket . . . . . $145 and a WESTERN SUPER (up to 30 h. p.) for replacing gear boxes on large boring mills, radials, Gisholt milling machines, etc.

Send for new 4-page catalog.

We can also supply necessary V-belts, sheaves, out-put pulleys and motors from stock. Prompt deliveries on high priorities.

up to 30 h. p.
WESTERN TRANSMISSIONS
For Metal-Cutting Lathes, Milling Machines, Shapers, Turret Lathes, Radial Drills, Slotters, Belt Cutters, Gear Cutters, Die Sinkers, Boring Mills, etc.
WESTERN MANUFACTURING CO. 2488 SCOTTEN - DETROIT, MICHIGAN

Timken Roller Bearing Company recently announced the appointment of W. H. Richardson as general manager of the Company on the entire West Coast and in the Orient. He is to be in complete charge in that territory for the sale and merchandising of roller bearings for original equipment in railroad cars and locomotives, automobiles and trucks, and all types of industrial machinery, as well as the sale and merchandising of bearings for replacement purposes. He will also supervise all sales of Timken Steel and Tubing.

KIPP air GRINDER

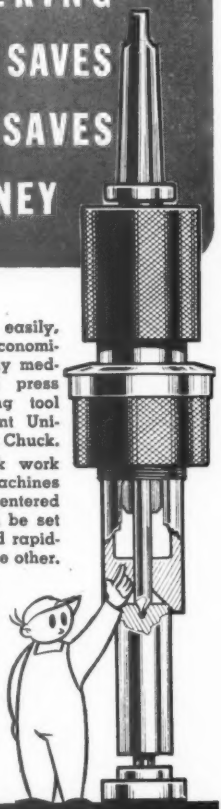
Madison-Kipp tool-makers originated the first really high speed grinder. They know a great deal about the practical side of grinder design and grinder usage. They think the new Model H is the best all around off-hand tool they have ever tried and we are sure you will agree with them. If you are doing priority work . . .

ONLY $29.75 MODEL H

Order Today!
PROMPT DELIVERIES ON THE HIGHER PRIORITIES

MADISON-KIPP CORP.
212 WAUBESA STREET
MADISON, 4, WIS., U. S. A.

UNIVERSAL CENTERING CHUCK SAVES TIME • SAVES MONEY



Now you can easily, quickly and economically convert any medium sized drill press into a centering tool with the efficient Universal Centering Chuck. With this chuck work from screw machines that has been centered on one end can be set on the press and rapidly centered on the other. A feed adjustment regulates the depth of center. Concentricity and uniform depth of centers are maintained. Write for further facts.

UNIVERSAL ENGINEERING
FRANKENMUTH, MICHIGAN

INDUSTRIAL DIGEST

(Continued from Page 135)

Moore Distributes Lacey Die-Set Machine

Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn., has taken over the distribution of the Lacey Portable Die-Set Machine for tool and press rooms. This machine enables the die maker to complete a die-set right at his bench. With the die shoe clamped to the table and the punch holder fixed in position in the ram, the punch can be removed as often as needed without disturbing alignment. Punch and die may also be separated easily, without the use of a pry-bar or hammer.

Because of the rapidity and versatility of press production, manufacture by this method constitutes a major factor in present day business and consequently warrants close and careful examination by industrialists in many spheres. The speed of operation of many types of modern presses is such that it can rarely be approached by any other methods. Indeed press production is now in some instances being substituted for other means previously employed.

Tools for Power Presses

Materials normally processed with power press tools are sheet metals of every kind which have to be cut to shape, pierced, bent, raised, stamped or drawn to shape. Swaging, squeezing and coining processes, where metal forms are heavily compressed between opposing steel dies, are done in powerful presses to reproduce patterns, forms, figures and lettering cut in the dies.

Power presses can be tooled up for trimming off flash from steel drop-forgings, from hot brass pressings and from die castings. Nonmetallic materials such

(Cont'd. on Page 186)

SPEEDS PRODUCTION! CUTS TIME AND COSTS!

SPEEDY AIR VISE

FAST! POWERFUL!
FOOT CONTROLLED!

$24

Complete with Foot Control Valve, Air Hose and Fittings

HAND FREE OPERATION!

• Foot operation leaves BOTH hands free for fast insertion and removal of work. Vise stays open or closed without constant foot pressure.

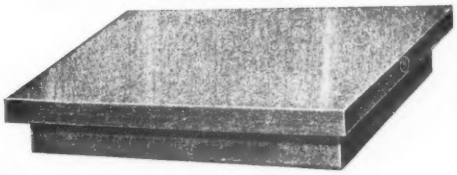
PROMPT DELIVERY!

•At last! A powerful pneumatic vise at a remarkably low price! Expertly engineered, SPEEDY AIR VISE is fast in action, hard gripping, husky, easy to operate...just the vise you need to speed up your production. Operates from air line or individual compressor, exerting a grip of 15 times air pressure. Jaw opens up to 3 inches, easily fitted to hold castings, parts, jigs etc. Because of its low cost, can be economically used on every drill press, miller, filer and assembler.

Ask Your Dealer, or Write For Circular 9-H

W. R. BROWN CORP., 5720 ARMITAGE AVE., CHICAGO, ILL.

HERMAN
PRECISION GRANITE
SURFACE PLATES



Distinctly New . . . Definitely Superior

Herman PRECISION GRANITE Surface Plates eliminate once and for all the disadvantages and uncertainties of old-fashioned metal surface plates. Cut from solid granite, they cannot warp and will remain accurate to 1/10,000 inch overall. Practically non-porous, they do not become charged with tool damaging abrasive particles. Corrosion and rust-proof, they are as nearly indestructible as man and nature can make them. Already scores of shops throughout the country have declared them unequaled for precision work. Let Herman PRECISION GRANITE Surface Plates increase production efficiency and economy in your shop. Write today for full information.

THE HERMAN STONE CO.
1242 Leonhard St. Dayton, Ohio

Standard Sizes and Weights

12" x 18"	—	75 lbs.
18" x 24"	—	160 lbs.
20" x 30"	—	275 lbs.
24" x 36"	—	480 lbs.

Custom Sizes on Request.

Prices are Reasonable

Specify "Unbrako" Socke Cap Screws with the *Knurled Heads.* Mechanics appreciate the firm, nonskid grip which the *knurling* affords thereby speeding up production. Then too, the *knurling* permits locking after countersinking. Sizes: No. 4 to 1½" diameter. Write for the "Unbrako" catalog today.

Knurling of Socket Screws originated with "UNBRAKO" years ago.

★

Standard Pressed Steel Co.
BOX 600 JENKINTOWN, PENNA.
Over 40 Years in Business

(Continued from Page 184)

as plastics and fibre can also be cut, formed or compressed. Special types of pelleting presses are now used in connection with compressed concentrated poultry and animal foods, as well as for medical tabloids.

When drawing sheet metal into shell form, the metal is caused to flow between punch and die so that it is necessary to hold the outer rim of the blank between the die face and a blank holder or pressure plate attached to the outer slide of the press so as to prevent the metal from wrinkling as it is drawn into the die. The punch is carried on the main ram. Both ram and outer slide are adjustable so that pressure on the blank may be regulated and different depths of draw be arranged. Where it is considered inadvisable to draw a shell to the requisite form or depth at one press stroke, further operations in redrawing tools are arranged.

Large users of pressings have perforce to plan for economical production. Standardization reduces the number of tools and the amount of equipment to the minimum and also facilitates tool design and construction and saves time in tool changing. Standardization will be governed by the range, type and size of pressings dealt with and by the presses in use. To ensure a good margin of safety, it is advisable to employ presses of a capacity well above the calculated pressures required. This factor must also be taken into account when designing and standardizing die bolsters, adaptors and feeding devices.

Materials used for press tool construction range from ordinary grey iron castings up to super high-speed steel. Medium runs of light gage drawn work can often be accomplished with tools of close-grained cast iron. On the other hand, where long trouble-free runs of accurate pierced blanks which must be free from burrs are required, careful steel selection is necessary, choosing that which

(Cont'd. on Page 188)

Subject to prior order, of course, but you've got a pretty good chance of getting Zagar Index and Holding Fixtures immediately if you order now.

Zagar Holding Fixtures are ideally suited to multiple set-ups on rotary work tables for multi-station operation. Get FAVORABLE PRICES on SIX OR MORE FIXTURES for this purpose.

Get New Bulletin D-9

Center drilling long shafts on drill press at rate of 155 center-drilled holes per hour. Drill bushing is used as stop, maintaining uniform depth of center. Minimum drill breakage, because center drill is properly guided and runs at correct speed. 1-inch Zagar Holding Fixture shown.

ZAGAR TOOL, INC.
23880 Lakeland Blvd. Cleveland, Ohio

Sure . . .
SHE'S GOOD LOOKING

And—

SHE IS SETTING A NEW HIGH PRODUCTION RECORD WITH A . . .

BARKER

WRENCHLESS CHUCK

Three-Jaw Chuck

Two-Jaw Chuck

Three-Jaw Vise

Two-Jaw Vise

Whether you employ experienced machine hands, or wartime women operators, you will get more pieces per hour and lower unit costs when you equip lathes, and threading, cutting-off, and drilling machines with Barker Wrenchless Chucks and Vises.

These Barker Devices are simple to install, easy to operate, and very moderate in price. Ruggedly built, they will remain accurate during many years of hard service.

Send piece part prints and outline of operations—our engineers will make cost-saving recommendations by return mail.

WRITE FOR FREE BULLETIN

THOMAS HOIST CO.
Chuck Division
20 So. Hoyne Ave., Chicago, Ill.

HERE'S A BETTER, FASTER WAY TO SPEED THE BURRING OF HOLES!

NOBUR

1. NOBUR's double-edged cutting blade instantly removes burrs around holes in flat or curved surfaces of single or multi-walled parts—smoothly and accurately.
2. Used in the spindle of any machine, operator works with complete safety at all times.
3. Parts can be burred as fast as they can be handled.
4. Available in $\frac{1}{16}$" progressive sizes from $\frac{3}{16}$" to 1".
5. Eliminates costly hand methods of burring holes—cuts burring time to minimum.

Write for complete information NOW!

Note how readily NOBUR is used to burr curved surfaces.

Multi-walled part is easily and quickly deburred on all surfaces.

NOBUR MANUFACTURING CO.
912 NO. ORANGE DRIVE, LOS ANGELES, CALIF.

(Continued from Page 186)

will retain cutting edges for the maximum time between grindings and which will neither chip in use nor change shape during heat treatment. Short runs of certain shallow stamping, raising and bending operations can be covered by the whole or some portion of the tools made up from hard wood, cast zinc or from the low melting-point bismuth alloys.

Condensed from "Tools for Power Presses" originally published in Machinery Lloyd, England.

AMIC COMPARATOR

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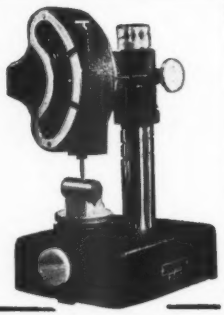
A Precision Indicating Gage



Our extensive experience will solve your measuring problems

DESIGNED to replace special gages, flush pin gages, snap, height gages. For accurate, convenient and quick checking of components, either in the tool room or on the production line. Permits precise gaging throughout the whole day without eye fatigue. Each division of the scale represents 1/10,000th of an inch. Interpolations of .00005 easily achieved. Clear readings on 6" scale with inch and millimeter readings. Magnification is 1000. Measuring capacity is ±.003" and ±.05 mm.

Accessories

NOTE our improved list of accessories designed to suit your particular measuring problems. Thread measuring device, serrated anvil, vee-blocks, centering fixture, ball anvil and several types of backstops.

AMERICAN MEASURING INSTRUMENTS CORP.

240 West 40th Street **New York, N. Y.**

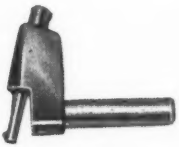
MANUFACTURERS OF GAGES, JIGS, FIXTURES AND SERVICE TOOLS

Automotive Maintenance Machinery Co., N. Chicago, Ill., manufacturers of automotive precision equipment and machine tools, received the Army-Navy E Award for outstanding achievement in producing war equipment.

Recent Army-Navy E Awards

For their notable achievement in producing the grinding wheels, coated abrasives, refractories and other products of the Carborundum Company vitally necessary in the tremendous war effort, the Army-Navy E was presented to the employees of that company. Abrasive products made by Carborundum have such a wide application in all types of industries that it is practically impossible to name a single instrument of warfare in the production of which grinding, finishing or polishing does not enter. The parts of thousands of machine tools, shells and projectiles, reamers, cutters and drills are being turned out on a mass production scale previously undreamed of. Grinding helps to make possible not only this increased production, but furnishes the means for achieving greater accuracy as well.

(Cont'd. on Page 190)



Attachment for Full Semi-Circular Radii

Only tool of its kind! Use with Golconda Rattail Diamond Tools to make full semi-circular radii as small as 0.035". Available at small extra cost.

$61.00 Radius Dresser with one 90° GOLCONE Diamond Tool

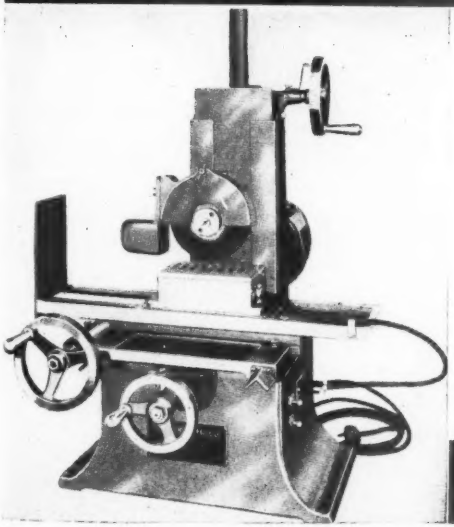
$97.50 Complete with 2 Golcones (60° and 90°) one crystal point, one roughing tool, one Semi-Circular Radii Attachment, and 3 Rattail Diamond tools (1/8", 3/32", 1/16").

MAKE-ALL RADIUS DRESSER

Simple to set up . . . easy to operate . . . the Make-All Radius Dresser requires no difficult calculations, no depth gauges, micrometer nor vernier setting. Only one moving part assures extreme accuracy. Makes Concave and Convex Radii. Send priority rating with your order for quick delivery.

Golconda Diamond Products Corporation 3854-58 No. Ashland Ave. Dept. TD-2, Chicago 13, Ill.

Sanford precision bench surface grinder



A
HIGH SPEED GRINDER
FOR ALL
SMALL PRECISION WORK

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Write for Specifications Bulletin No. C

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IMMEDIATE DELIVERY

SANFORD MFG. COMPANY
1279-81 SPRINGFIELD AVE., IRVINGTON 11, N.J.

(Continued from Page 188)

Detroit's First Tool Shop Celebrates 54 Years of Service

Detroit's vast growth as a mass production and metal working center has many interesting historical highlights, but none are more human or marked with the tradition of craftsmanship than Detroit's first tool shop, the C. M. Smillie Co., founded in 1889 by Charles Moffatt Smillie, Sr.

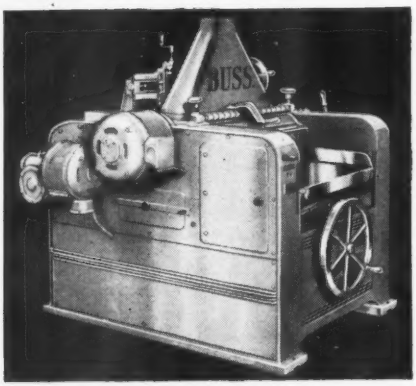
As a craftsman working throughout the railroad and lubrication industries in the eighties, Mr. Smillie had seen the need for better manufacturing through a company specializing in building precision tools. In the Smillie shop for many years, handcrafted toolmaking built many of the special tools, taps and die heads that contributed to railroad building and repairing. With the advent of the automobile, Smillie was one of the first shops to make automotive tools and dies.

World War I found the Smillie Company making a real contribution by supplying the precision tooling demands for the automotive and allied industries producing war equipment. All through this period Smillie maintained a compact shop which stressed individual craftsmanship.

Today, the Smillie Company, as a modern precision parts manufacturer, is utilizing its 54 years of tool craftsmanship in the tooling and production of hundreds of different precision parts for America's war weapons. When the present war began, Charles M. Smillie, Jr., who had served as an apprentice in a number of Detroit's shops, took active charge of the company. Under his direction the company moved into its large plant at Ferndale, completely equipped with modern precision machinery.

(Cont'd. on Page 192)

BUSS *Wood Surfacers*



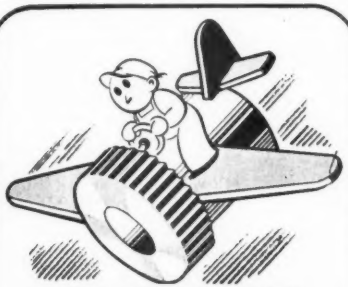
GIVE YOU THE ABSOLUTE PRECISION ESSENTIAL IN PATTERN AND JIG MAKING!

—plus faster change-over, greater convenience of operation and the assurance of years of perfect service. Write for Bulletins Type 4-L showing the many patented features which make this the finest of all surfacers for pattern and jig departments. Production Models to suit every circumstance. We specialize in surfacers.

BUSS MACHINE WORKS
214 EIGHTH ST. HOLLAND, MICH.

Shipments of machine tools for July totalled $97,428,000, a decrease of approximately 10.4% in value from the June total of $108,689,000, the Tool Division of WPB announced.

The accumulated backlog of unfilled orders at the end of July was $441,311,000.



HIGH PRODUCTION OF UNIVERSAL DRILL BUSHINGS HELPS SPEED UP AMERICA'S WAR WORK

From coast to coast America's war plants are speeding their war work with Universal Drill Bushings. They are straight and round, have superfinished bores to insure accuracy and unexcelled wearing qualities. It pays to use Universal Drill Bushings. Write for catalog.

UNIVERSAL ENGINEERING
FRANKENMUTH, MICHIGAN

Shipment from warehouse STOCK

HY-TEN

S.A.E. • A.I.S.I. • N.E.
ALLOY STEELS

Scientifically selected and designed to conserve critical alloys and meet the carburizing or heat treating requirements of the Machine Tool and Aircraft industries. Call our nearest office and warehouse for up-to-the-minute information.

WHEELOCK, LOVEJOY & CO., INC.

CAMBRIDGE • CLEVELAND
CHICAGO • NEWARK
DETROIT • BUFFALO
CINCINNATI

(Continued from Page 190)

He inaugurated the Smillie Employee Precision Award to honor and maintain the precision standards which Mr. Smillie, Sr. carried through all the years of active work. The emblem, consisting of a gold Victory pin with the V in the background of an American eagle, is awarded all employees who meet the company's precision standards of workmanship.

The expansion of machine tool production and the efficient allocation of machine tools has been one of the cornerstones of Canada's war production programs, Hon. C. D. Howe, Minister of Munitions and Supply, said recently in a report on Canada's industrial efforts in the war.

Canada's Machine Tool Picture

In the production of heavy guns and small arms, Canada had achieved mass output on a constantly rising scale. Toward the end of 1942, the monthly ordnance output was greater than it had been for the entire year 1941. Canada, making 12 types of heavy ordnance and 16 types of carriages and mountings, to date has produced 55,000 guns, gun barrels or mountings. Weekly production rate is now 940 units — 570 guns and gun barrels, and 370 mountings.

"Original schedule for the No. 4 Army rifle, Canadian version of Lee-Enfield now being produced in the government-owned and operated Small Arms, Ltd. plant, was doubled during the past year, and our present output is now in excess of 34,000 a month" the minister reported. "Production of this weapon will be increased to better than 40,000 a month.

"There will be a substantial increase, too, in the production of a wide variety of other naval equipment. For example,

(Cont'd. on Page 194)

No delays— a new gage always at hand for instant service.

DUBLIFE *Reversible* PLUG GAGES

When one end, *either* "Go" or "No Go", indicates wear, all you have to do is reverse the plug, bringing *new* end into use. Change easily and quickly made. Tapered bronze collet locks plug securely in handle. Dublife insures accuracy *at all times*—doubles precision life!

SEND FOR COMPLETE GAGE CATALOG
Shows complete line of UPPCO-lapped DUBLIFE, and other gages of A. G. Design. Full engineering data. Wire or write

UNITED PRECISION PRODUCTS CO.
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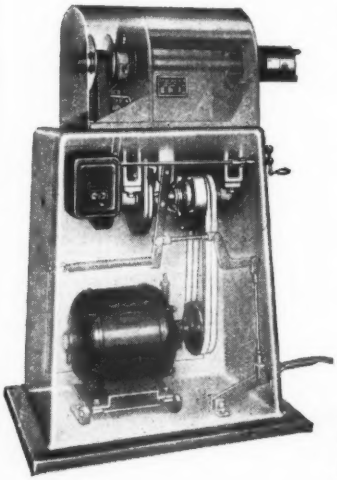
NEW VARIABLE SPEED LATHE

BREAKS BOTTLENECKS



If precision finishing of metal or plastics parts is your bottleneck, use Schauer Speed Lathes—today's efficient method of polishing, burring and lapping of small parts. A size and type for every purpose.

Schauer Speed Lathe—VA3B-C

For filing, polishing, lapping gages, gears, pinions, pulleys, etc. Variable speeds, from 100 to 4800 r.p.m; Reeves Drive; Twin Disc Clutch Assembly, Automatic Brake, foot treadle controlled. Write for descriptive bulletin.

SCHAUER Originators of SPEED LATHES

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for SPRINGS

made to precision standards for instruments, dies and tools—specify GIBSON, product of 65 years specialized experience. Scientifically designed for the work they are to do, made to exact specifications, heat treated and thoroughly tested, they function more accurately, last longer, save time in assembly and adjustment, reduce spoilage, cut costs all around. Investigate! Write us about your requirements.

THE WILLIAM D. GIBSON CO.—CHICAGO

1800 Clybourn Ave. Phone, MOHawk 6622

(DIVISION OF ASSOCIATED SPRING CORPORATION)

(Continued from Page 192)

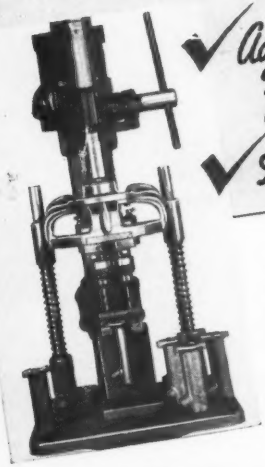
Canada is now producing in quantity 20 or more components of naval torpedoes . . . and the output of all these will be increased," Mr. Howe said.

Machine Gun With Plastic Bullets

A machine gun using plastic pellets and compressed air instead of expensive bullets and gunpowder, yet providing all the racket and recoil vibrations of a wartime anti-aircraft weapon, has been developed by Edison General Electric Appliance Co. for use in training soldiers at less cost. The gun, operated by electricity, will fire 600 rounds of the plastic bullets per minute—the same rate as the 50-calibre Browning machine gun. Whereas 50-calibre bullets cost approximately 30 cents each, the plastic pellets cost less than one cent each and can be used repeatedly.

The gun, built to actual size and appearance of the Browning, is handled exactly like one except that its operation is on a scale of 1 to 30. Thus, when fired at miniature buildings and tanks or airplanes zooming across the sky at a distance of 50 feet, it simulates an actual gun at 500 yards. Pellet velocity and trajectory are according to scale, hence the trainee learns correctly to "lead" a moving target and to aim his gun.

TWO SPINDLE
Adjustable
DRILL HEADS
Drill Two Holes At Once



✓ *Adjustable Centers from ½" to 6"*
✓ *Drill Capacity 0 to 5/8"*

Sleeve and overarm types . . . in several sizes. Will double output of any single spindle drill press.

Quickly adjusted to desired drill centers from ½" to 6".

Send for bulletin.

LINDERME MACHINE & TOOL CO., INC.
12250 Coyle Ave., Detroit 27, Mich.

George W. Long

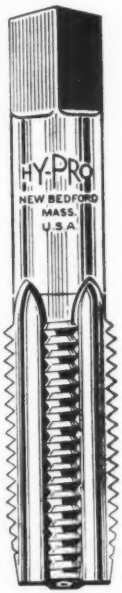
George W. Long, vice-president of Simmons Machine Tool Corp., Albany, N. Y., and a member of the firm for over thirty years, was drowned while canoeing on Lake George, New York, July 22. Mr. Long joined Charles A. Simmons shortly after the company was formed in 1910 to handle and rebuild used machine tools. He was one of its first employees, and recognized as an authority on all types of machine tools, regardless of age or size. During the last two years,

(Cont'd. on Page 196)

HY-PRO

TAPS

High Speed Steel



HAND and MACHINE SCREW TAPS

Cut Thread, Commercial and Precision Ground Thread Taps

Special Ground Thread Taps

Send for Catalog on Company Letterhead

HY-PRO Taps have Clean, Sharp, Accurate Threads for High Production

BUY MORE BONDS

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★ WITH a Rousselle Victory Vise, accurate set-ups are simple—and fast! This is due to many features such as complete, easy-to-read graduations around the entire dial on the broad swivel base—the two convenient locking screws that hold your swivel setting securely—the lock nut on the main screw—extra ruggedness in the broad base, center pin, jaws, ways and screw—all of which assure long-lived precision. The hardened steel screw nut is removable and although the bearing areas on ways and sliding jaw are over-size, a special take-up plate provides constant alignment regardless of wear. Jaw plates are tool steel, hardened and ground. Point-by-point superiority in every detail has made the Rousselle the choice of experts. Get full data in Bulletin TD-93. Write today.

PROMPT DELIVERY — PRIORITY CERTIFICATION MUST ACCOMPANY ORDER.

Dealers: Write for dealership plan.

Rousselle Victory Vises are made in four sizes.

DAVID J. ROSS CO.
BENTON HARBOR MICH.

(Continued from Page 194)

besides his work with the Simmons firm, he was frequently consulted by the Army and Navy to assist in locating critical machine tools.

[CAMCO adds New Line

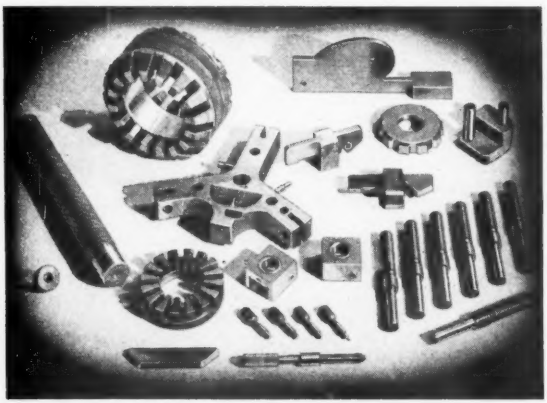
Cleveland Automatic Machine Co., makers of automatic screw machines and single spindle automatics, has added a line of high pressure, hydraulic die casting machines with the purchase of G & N Mfg. Co. The take-over provides for both the manufacture and sales of the die casters to take place at the Camco plant at 2269 Ashland Rd., Cleveland, without interruption of production or deliveries.

Immediate stepping up of development of the magnesium alloy casting machine as well as some post-war planning for developments in the injection molding of plastics are phases of the program behind the move, according to Millar Brainard, president of the new G&N Division of the Cleveland Automatic Machine Co., under which name all activities will be directed.

Advantages claimed for the G&N construction were that it is capable of extremely high pressures without danger of breakage. In addition to the inherent strength of the welded steel plate construction, a patented toggle mechanism was credited with providing a locking pressure upwards of 800,000 pounds with a minimum of strain on the machine itself.

The machine is so designed that the same die locking assembly can be used with interchangeable hot metal ends—one for zinc, tin and lead alloys, the other for aluminum, brass and magnesium alloys. Changing of hot-metal ends can be accomplished after installation, if desired.

WALTHAM GAUGES



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★ GAUGES A SPECIALTY ★

★ We manufacture all types of precision limit gauges. Either standard or specially built to your requirements. Fast, dependable service. Finest craftsmanship. ★

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CUT HOLES - QUICK!

1.

Cut true circles quickly, smoothly in any curved metals, plastics, wood, transite.

2.

Blades are adjusted to exact diameter. Pilot or lead drill acts as guide. In drill press, holes are cut accurately, quickly. No after reaming or deburring.

3.

Clark tools are ideal for curved surfaces, thin materials, overlapping cuts, many others.

CLARK ADJUSTABLE HOLE CUTTERS

All curved and flat surfaces. 7 sizes cut any fractional diameter 5/8" to 5", up to 1" thick. Blades easily resharpened with Clark Model C Grinding Fixture, built especially for grinding Clark blades at correct angle.

CLARK ADJUSTABLE FLY CUTTERS

Pitched blades cut clean holes or discs 4" to 10", up to 1" thick. Model 25G Gasket Cutter quickly cuts gaskets, rings, discs from live rubber, packings, thin plastics. Has retractable pilot and knife edge blades.

Robert H. Clark Co.

3424 SUNSET BLVD., LOS ANGELES 26

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In Canada: Dominion Bearings, Ltd., Toronto, Montreal, Winnipeg
Export: The American Steel Export Company, Inc., New York, Los Angeles

MAJESTIC INTERNAL GRINDING MACHINE

The Majestic Internal Grinder meets the exacting requirements for internal grinding operations in the tool room and die shop. It offers reliable, balanced operation, maximum output and valuable help for all-out production.

Sturdy and durable, the Majestic Internal Grinder is equipped with Parker spindle and motor. Parker ball bearings and standard rotor and stator assure perfect balance for smooth spindle movement.

An adjustable work head has a graduated base which swivels 90 degrees on each side of the center for taper grinding.

Send for valuable circular.

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Federal Taperlock
Plastic GAGE HANDLES

Federal Plastic Gage Handles give gages a more sensitive touch because they are lighter than any metal. They reduce fatigue and insulate from bodily heat safe-guarding accuracy ● Marked for identification with the same stamps used for marking metal handles ● Ideal for Glass Gages which require handles of light weight for best results, reducing danger of breakage as well as adding to sensitivity ● Available for immediate shipment in 6 Standard sizes and in Red, Yellow, Green and Black for easy identification ● New low prices represent real savings.

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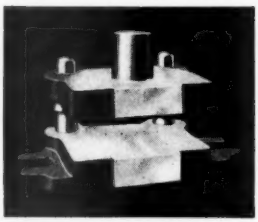
PRODUCTO DIE SETS

ARE TOPS ON THE PRODUCTION FRONT

TOPS is the Word for Producto Service on Die Sets and Die Makers' Accessories from Bridgeport, Detroit, Cleveland and Los Angeles.

Enlarged facilities at the above assembly plants assure prompt shipment today on catalog items.

Special Die Sets can be shipped without delay from Bridgeport or Detroit.



THE PRODUCTO MACHINE COMPANY

3017 MEDBURY, DETROIT, MICH.

990 HOUSATONIC AVE., BRIDGEPORT, CONN.

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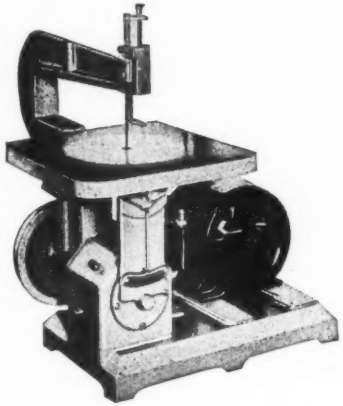

ATLAS DIE FILING MACHINES

Can be used for all kinds of die making. The overarm is constructed so that the file and saw attachments may be interchanged with little effort. The hold-down fingers are attached directly to the overarm. Working surface of the table, which tilts two directions, is entirely clear. An improved type of chuck, consisting of movable hardened jaws, holds both saws and files. Screw adjustment makes changes easy and fast.

COMPLETE WITH MOTOR—$125 NET
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ATLAS EQUIPMENT COMPANY
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On Standard Sizes

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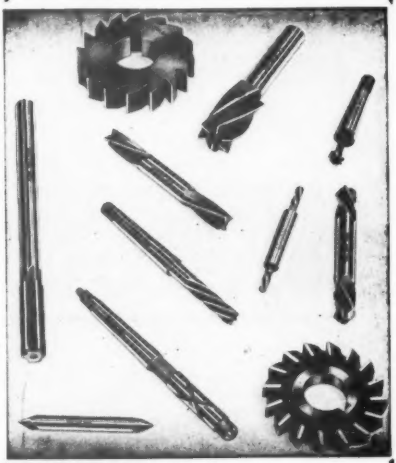
HIGH GRADE TOOLS



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MULTIPLE CROSS SLIDE STOP

SETS 6 DIAMETER STOPS FOR REPEAT OPERATIONS

AMERICAN MODEL DS-1

- PREVENTS SPOILED WORK
- INCREASES PRODUCTION
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All necessary parts are supplied with each Multiple Cross Slide Stop.

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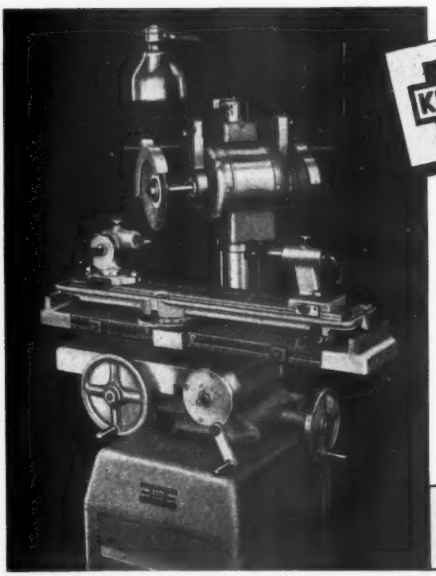

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The New

K-O UNIVERSAL TOOL GRINDER

now coming off the assembly line. Maintenance or production with speed, accuracy, and dependability at minimum capital outlay.

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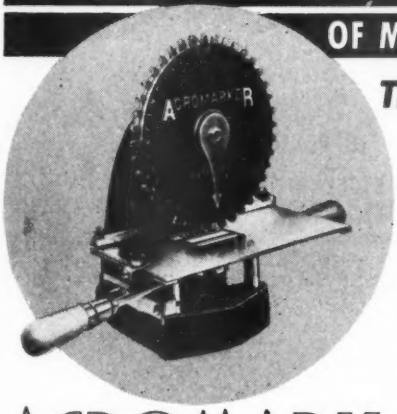

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The No. 1 Model is especially suited for fast marking, numbering and lettering serial numbers, voltage indications, code letters, identification marks, manufacturers' key, etc. Easy to operate, the No. 1 Acromarker requires merely a swing of the handle to exert powerful screw pressure of the dies on the parts to be marked. Deep, accurate marking on stainless steel, cold rolled steel, brass, bronze, zinc, tin, plastics, fibre or other materials. Dies are automatically advanced for character spacing, and are replaceable. The Acromarker represents one of the most widely used marking machines on the market today.

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Write for descriptive literature.

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Empire LIVE CENTER
WITH REPLACEABLE POINT

GREATER ACCURACY • LONGER LIFE • HEAVIER LOADS • FASTER PRODUCTION

No. 2 MT $25.00
No. 3 MT 27.50
No. 4 MT 38.50
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MOST ADVANCED LIVE CENTER MADE!

Replaceable point affords indefinite life—Tapered seat maintains perfect alignment—Very short overhang eliminates chatter—Special preloaded heavy duty bearings for heavier loads—Point is hardened and ground tool steel—Case is hardened and ground—Seat of case ground on bearings—Special points available on request.

FISHER TOOL COMPANY
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BOYAR-SCHULTZ SMB BOLTS
Save the Machine, Save the Job, Save Time

Poorly made machine bolts or bolts that have become worn and distorted can cause great damage to the accuracy of machine beds. Accuracy thus destroyed can be restored only at considerable expense and loss of time.

SMB BOLTS ARE MADE FROM ALLOY STEEL

Boyar-Schultz SMB Bolts are made from alloy steel, heat treated for maximum properties. They are machined with head square with body, assuring a clean, flat bearing surface to fit the upper side of T-slot. Work is held tightly under heavy machine cuts and close adjustments are possible.

For best results use SMB Nuts and Washers. They are specially made for SMB Bolts.

SMB Nuts specially made to fit SMB Bolts. Clean cut threads.
Alloy Steel heat treated for strength and toughness.
Head machined square with body.

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Boyar - Schultz Corporation
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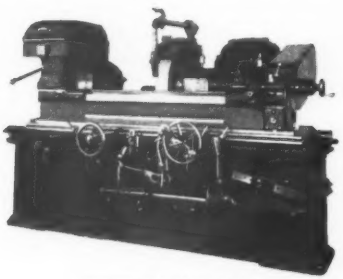
Variations of as little as 0.00005" in size, out of round, and taper of bores can be quickly and accurately determined.

A light, easily handled instrument for use on internal grinding, diamond boring or honing machines; or wherever a reliable method of accurately determining bore diameters is required. Its use by machine operators for final inspection INCREASES PRODUCTION, REDUCES SCRAP and assures A MORE UNIFORM PRODUCT. Scale range: Plus or minus 0.001" graduated to 0.0001" and minus 0.020" graduated to 0.001". The plus or minus 0.001" range graduated to 0.0001" is used for checking the finished part. It can be set to any required size direct from Johansson Gage blocks or master ring.

SWEDISH GAGE CO., OF AMERICA
8900 ALPINE AVE. DETROIT 4, MICH.

HILL-CLARKE
Modernized
CYLINDRICAL GRINDERS
for **SUPER-GRINDING**
and **MICRO-FINISH**



Hill-Clarke Modernized and Motorized Cylindrical Grinders offer refinements in design which minimize vibration and assure extreme accuracy on all grinding operations. One of these refinements, the Hill-Clarke Patented Multiple V-Belt Drive to work spindle, contributes to the smoothness in operation which makes possible a finish within a few micro-inches even when using standard grain free-cutting wheels. Investigate today by sending for a copy of the Hill-Clarke catalog "Super Grinding."

SIZES AVAILABLE

10x36	10x72	14x72	16x72
10x50	14x50	14x96	18x96

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BUILDERS 'T' SURFACE GRINDER

Patented T-square action guides table longitudinally and transversely . . . eliminates intermediate table. Extreme accuracy and a high quality finish are assured by single precision-ground table bearing, resting on plane ground surface of the bed with but one oil film subject to grinding pressure.

PROMPT DELIVERY

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BUILDERS IRON FOUNDRY

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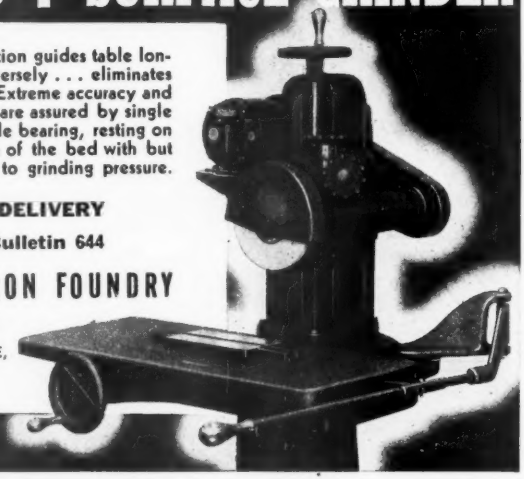
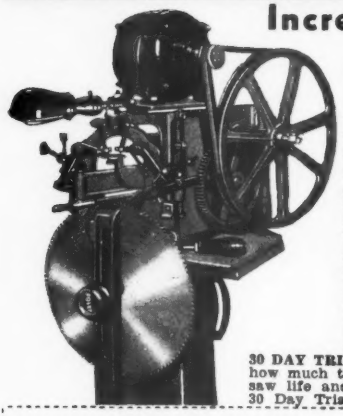


FOLEY FILED SAWS



Increase Sawing PRODUCTION

25% TO 40%

Your saws will cut faster and truer and stay sharp longer when filed on a Foley Saw Filer, which automatically joints the saw as it is filed. The exclusive patented Foley jointing principle straightens up uneven teeth and makes them perfect in size, shape, spacing. Foley automatic filing not only increases sawing production 25% to 40%, but greatly reduces saw breakage and doubles the cutting life of your saws. Any man or boy can operate the Foley Automatic Saw Filer, the only machine that sharpens crosscut circular saws 3" to 24" in diameter, band saws ⅛" to 4½" wide—all hand saws. It cuts down filing time and saves on files.

30 DAY TRIAL IN YOUR OWN PLANT. Find out on your own work how much the Foley Filer can save you in increased output, longer saw life and reduced filing costs. Send coupon for details of our 30 Day Trial Offer.

FOLEY MFG. CO., 4 Second St. N. E., Minneapolis 13, Minn.

Send literature and details of your 30-Day Trial Offer.

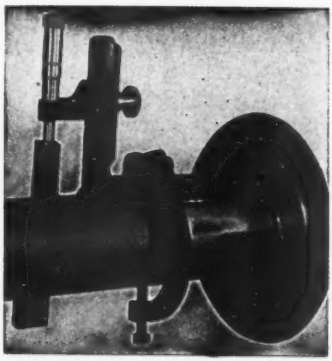
NAME.....

ADDRESS.....

BARTELT PEDESTAL MICROMETERS

formerly called Bartelt Tool Setting Gages

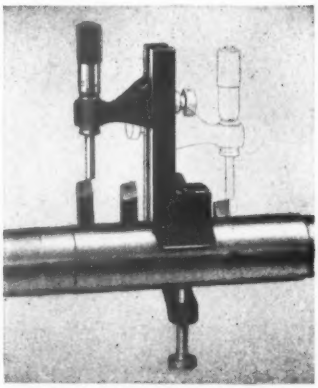
★ **These handy, practical gages will speed up boring work and help to produce accurate results more easily. Inexperienced hands are aided toward becoming good workmen more quickly. Available in two models, as shown. Three clamps furnished, to fit all boring bars from 1″ to 5″ diameter.**



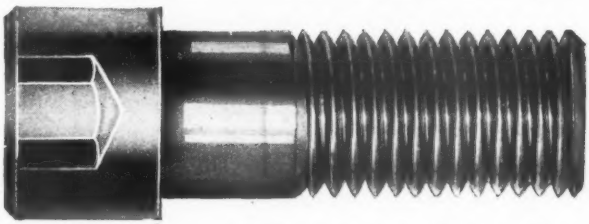
MODEL "A" ←

MODEL "B" →

Write for Circulars



BARTELT
ENGINEERING COMPANY
1212 PARTRIDGE AVE.
BELOIT • WIS.



STRONG ACCURATE

SAFETY "BLUE-DEVIL" CAP SCREWS

- Sturdy Cold-Formed Head with Unimpaired Continuity of Fibres
- Precision-Formed Hexagon Socket with True Sides and No Taper
- Increased Solid Metal Section at Union of Head and Body
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PITTSBURGH: L. A. REISMAN, 2035 FIFTH AVE.

NEW UNIVERSAL
GREENFIELD
GRINDER SPEEDS
TOOL AND CUTTER
GRINDING

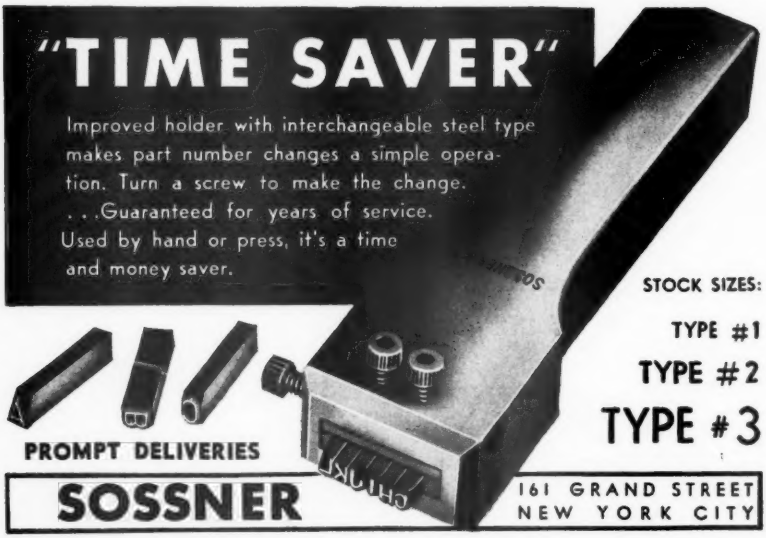
This machine can be furnished either as a plain cutter and reamer grinder, or as a Universal Type. Improved spindle construction, two speeds, attachments and versatility make this grinder a necessity in your tool room. An excellent investment that rapidly pays dividends.

Send for descriptive job application bulletin giving full details.

PRODUCTION MACHINE COMPANY
Greenfield, Mass.

"TIME SAVER"

Improved holder with interchangeable steel type makes part number changes a simple operation. Turn a screw to make the change. . . .Guaranteed for years of service. Used by hand or press, it's a time and money saver.



STOCK SIZES:
TYPE #1
TYPE #2
TYPE #3

PROMPT DELIVERIES

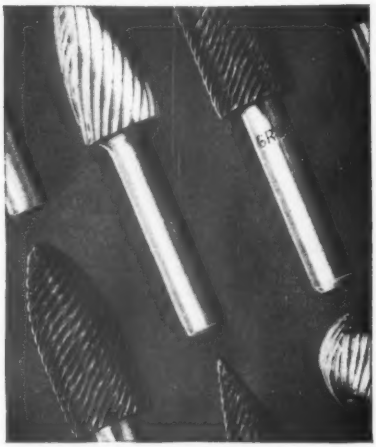
SOSSNER
161 GRAND STREET
NEW YORK CITY

Grobet
ROTARY FILES
HAND CUT • MILLED CUT
GROUND FROM THE SOLID

There is a GROBET ROTARY FILE in shape, size and coarseness of cut for every use—on steel and other hard metals, for aluminum, non-ferrous and softer metals, for wood, for plastics . . .

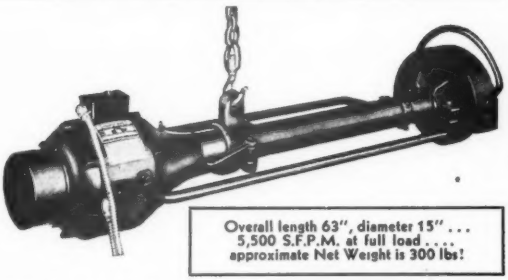
The engineering department of this long established company is at your service in solving filing, burring, reaming problems. Please write on firm letterhead.

Send for Complete Catalog YR



GROBET FILE CO. of AMERICA • 421 CANAL ST. NEW YORK CITY

NEW!
MARSCHKE
"In Between"
3 HP., Direct-Drive
Swing Frame
GRINDERS



Overall length 63", diameter 15" . . . 5,500 S.F.P.M. at full load . . . . approximate Net Weight is 300 lbs!

It fits admirably between small flexible shaft machines and heavy swing frame grinders. The direct motor-drive-ball-bearing construction lets the wheel get full use of the 3 HP, 1800 RPM motor. Placement of handles enables operator to supply two-handed pressure for maximum cutting from 12" x 2" wheel. Its combination of balance, swivel collar suspension and light weight enables operator to angle machine to any desired position and apply wheel to every exposed surface on all sizes and shapes of castings and is equally desirable and efficient for reducing seam welds of large plate, tank and other structural work. Write for full information to—

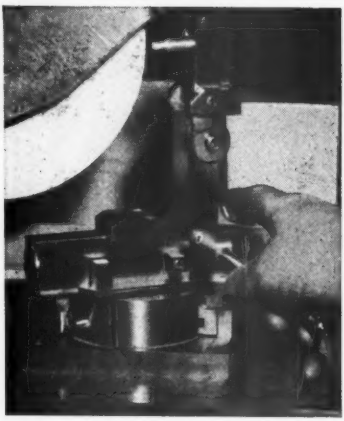
★ The MARSCHKE LINE ★

Manufactured and sold by the

VONNEGUT MOULDER CORP.

1853 Madison Ave.
Indianapolis, Ind.

A RADII & ANGLE DRESSER OF PRECISION AND VERSATILITY



MODEL B

An instrument of precision and versatility . . . Operation is simple, requiring no high degree of skill for accuracy . . . Any one of the following can be produced with one setting:

One angle
Two angles
Concave radii up to 6″
Convex radii up to 4½″
Two Angles and radius.

Many other diversified forms to meet requirements.

Wheel size capacity—4″–14″ dia.; angular travel—3″; base—4″ x 5″; height—diamond from base, 7½″; for use on universal surface and cylindrical grinders.

Full details available on request.

MANUFACTURED BY
J & S. TOOL CO. 477 Main St., East Orange, N. J.
PRECISION DRESSING TOOLS

EFFICIENCY for the PRODUCTION BATTLEFRONT

Speed Up Victory with "Oliver"

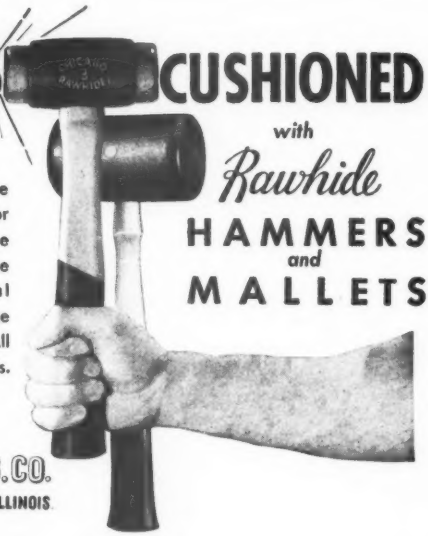
The tool behind the tool that does the job will help to speed up your production. 100% efficiency can be obtained only with tools that are well sharpened and kept in perfect condition. Speed up production by faster sawing and filing operations with Oliver Die Making Machines. They save 50% to 60% of the labor over hand methods in the cost of making precision Dies, Gages, Cams, Templates and similar products requiring rapid and accurate sawing, filing and lapping operations. It will pay you to investigate the line of Oliver Die Making Machines!

Send for descriptive literature today!

OLIVER INSTRUMENT COMPANY
1436 Maumee St., E. -:- Adrian, Mich.

BLOWS CUSHIONED

with *Rawhide* HAMMERS and MALLETS



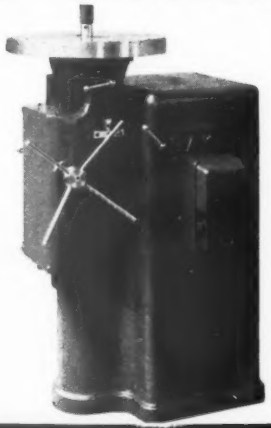
- Coiled Rawhide faces strike effective blows without marring or battering; speed up work; reduce spoilage. Hold true faces—strike accurately. Outlast several ordinary mallets. Reduce bounce and recoil—prevent fatigue. All sizes with light or weighted heads. Write for Catalog.

CHICAGO *Rawhide* MFG. CO.
1281 ELSTON AVE. ★ CHICAGO, ILLINOIS

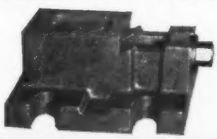
MODEL 3 CONTOUR GRINDER

For economical, rapid and accurate grinding and polishing of contours or irregular shapes.
Capacity, diameter of wheels—½" to 4". Capacity, face of wheels—2", 2½", 3". Diameter of table—18".
Vertical reciprocation movement of spindle—3/16".
Quickly - mounted diamond dresser is standard equipment.

Write for folder of complete details.



No. 43 LEVELING JACK



Maintaining of machines level on foundations is important to accuracy.

Write for circular.

BAKER *Brothers, Inc.*
Drilling, Boring, and Tapping Machines TOLEDO, OHIO

GAUGE MAKERS all over the country are standardizing on Smiths when **Precision Accuracy** is required. All Smith **SURFACE PLATES** are **MASTERS.**

Send for fully illustrated literature
Smith Master Surface Plates
Smith Precision Lapping Plate
Elliptical Rib Construction Exclusive with Smith
Smith Master Surface Plate and Stand

Available Sizes

8 x 12	18 x 24	30 x 36
9 x 14	24 x 24	30 x 60
12 x 18	20 x 30	36 x 68
18 x 18	24 x 36	★

★ Other sizes to order

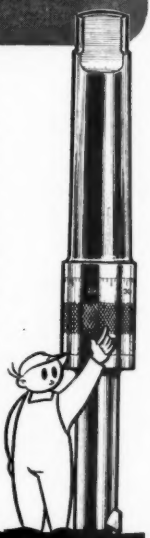
For prices and delivery, write, wire or phone

SMITH TOOL & ENGINEERING CO.
858 N. Sandusky Ave. Bucyrus, Ohio

George Scherr Co., 128-B Lafayette St., New York, N. Y., has just published an informative six-page leaflet containing complete operating instructions for the Wilder-Micro Projector. Included are suggestions that should make the Projector more valuable to users. **171-C**

UNIVERSAL MIKRO-LOK PRECISION BORING BARS

Tooling is now going forward to get on a production basis so that orders for the new Universal Mikrolok Precision Boring Bars can be filled more promptly. Universal Mikrolok Boring Bars can be adjusted as quickly and easily as a micrometer to limits of .0005 or less. Mikrolok cutting tools are extremely rigid, are available with taper shanks for Swiss Jig Boring Machines and with Morse shanks, straight shanks and a variety of flanges for Diamond Boring machines. Write for catalog.



UNIVERSAL ENGINEERING
FRANKENMUTH, MICHIGAN

Great for Honing, Grinding, Polishing!

EIS

HONE

Enlarges cylinders —Hydraulic, Pneumatic and Oil types.

Grinds and polishes long and short bore cylinders. Useful on bores of every description—Bushings, Ports or any round internal part.

Shops say: We wouldn't be without it!

MACHINE and tool shops that use the Eis Hone say they simply couldn't get along without this valuable time-saving tool. In the average shop there are many jobs where the removal of a few thousandths of an inch is a necessary process. This work is often done on expensive equipment, by slow, laborious methods. The Eis Hone does it in a jiffy, saving vital man-hours. Extensively used by plants engaged in War Work.

Three-stone expansion type—any tension. Two sets of stones, coarse and fine, for grinding and polishing.

Flexible or solid drive. Can be used in a machine tool, slow turning electric drill or flexible shaft machine. Three sizes, for bores from ¾" to 2".

Let us know your requirements and we will make recommendations

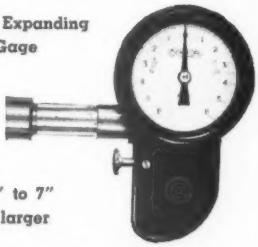
TOOL AND HARDWARE JOBBERS:
Ask for open territory

EIS MANUFACTURING CO., INC.
MIDDLETOWN, CONN.

Use MODERN gaging for precision bores!

COMTORPLUG

Patented Expanding Internal Gage



Sizes: ¼" to 7" dia. and larger

Comtorplug solves the problem of obtaining more precise tolerances with less skilled help. Its automatic accuracy enables learners to gage to fractions of .0001" with precise results. Shows size, front or back taper, out-of-round, barrel shape, bell mouth, etc. Widely used for inspection.

REQUEST BULLETIN 29

THE COMTOR CO.
82 Rumford Ave. Waltham, Mass.

FREE

illustrated and completely descriptive folder with prices of the newly perfected

CADILLAC GLASS SURFACE PLATE

Affords unique advantages—at low cost

CADILLAC GLASS CO.
900 WEST CERMAK ROAD
CHICAGO, ILL.

VALUABLE BOOKLET AVAILABLE

Forgings For All Industries
Rough Turned or Finished Complete

Composite Die Sections • Extrusion Tools • Crankshaft Forgings • Gear Forgings • Die Casting Dies

Rings, Discs, Blocks, Shafts, Hubs, Bars, and Special Shapes.
Tool Steel of all Makes

S.A.E. and NE Specifications
STAINLESS & COPPER FORGINGS
May We Serve You?

AJAX STEEL AND FORGE Co.
205 ADAIR STREET **DETROIT, MICHIGAN**

Revolutionizing METAL CUT-OFF OPERATIONS

NEW *Coolant Model*
KALAMAZOO
Metal Cutting
BAND
SAW

Handles 95 per cent of all cut-off work. FASTER, as cutting action is continuous. MORE ACCURATE, as it cuts to wafer-thin tolerances.

Small investment—low upkeep and depreciation—easy setup.

Coolant attachment speeds cutting and saves saws.

Two sizes — Four speeds. Portable—plugs in anywhere.

Detailed Bulletin on Request.

MACHINE TOOL DIVISION
Kalamazoo Tank & Silo Co.
Kalamazoo, Michigan

In War, as in Peace . . .

CERRO ALLOYS

SAVE TIME and CUT COSTS!

CERROMATRIX (Melting Temp. 250° F.) For securing punch and die parts, anchoring machine parts without expensive drive fits, short run forming dies and other metal-working applications.

CERROBEND (Melting Temp. 158° F.) Used as a filler in bending thin-walled tubing to small radii. Easily removed in boiling water. Also used for aircraft assembly jigs, templates for forming dies and other purposes.

CERROSAFE (Melting Temp. 190° F.) Used to accurately proof-cast cavities such as molds, gun chambers, forging dies, etc. and for many similar applications.

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40 WALL STREET - - - - NEW YORK, N. Y.

NEW BOOKLET *Describes*
LIGHTWAVE MEASUREMENT

★

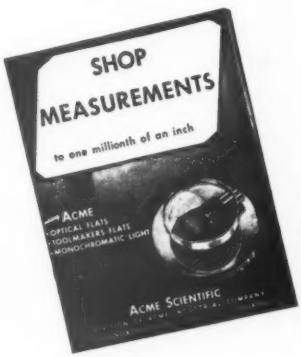
It's Yours For The Asking!

Write for Your Copy Today!

Just off the press . . . Acme's new booklet, "SHOP MEASUREMENTS to one millionth of an inch", describes in simple detail how Acme Optical Flats are applied in the procedure of lightwave measurement.

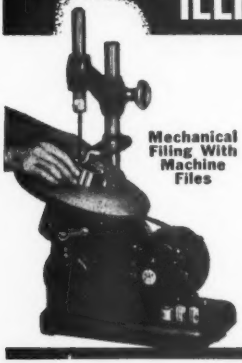
Illustrations and diagrams show how these flats can be used to check surface flatness, as well as their use for accurate comparison measurement in connection with precision gage blocks.

In short, this new booklet has been written in non-technical terms to make it easy for the average mechanic to thoroughly understand how to apply lightwave measurement in shop practice.



ACME INDUSTRIAL COMPANY
Makers of Standardized Jig and Fixture Bushings
206 N. Laflin St. Chicago, Ill. MONroe 4122

ILLINOIS DIE FILING MACHINE



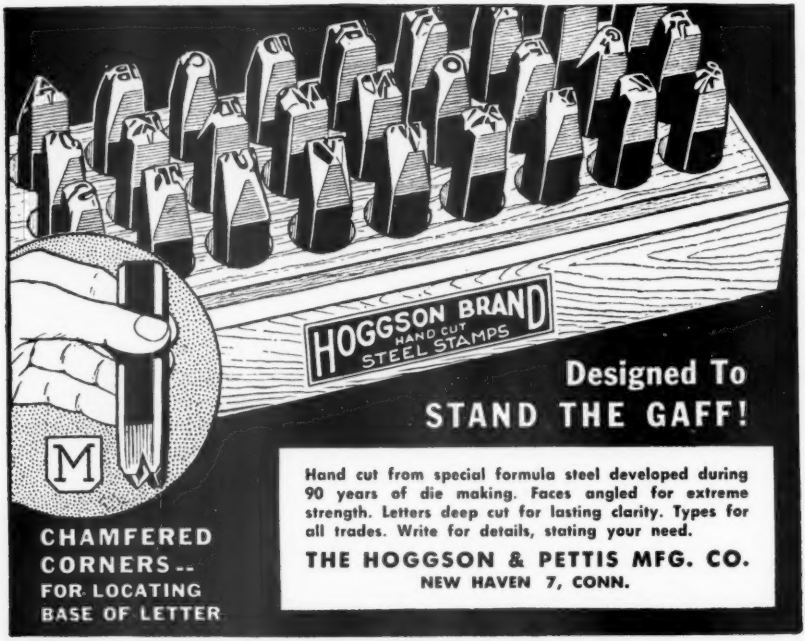
Reduce costs and improve quality with this TRIPLE-PURPOSE Machine

A versatile bench type machine for all three major production steps in the die-making process—sawing, filing and stoning. Quality built throughout to stand up longer and produce more accurate work. Forced-feed lubrication plus hardened and ground shafts running in bronze bushings combine to minimize wear and prolong life. Maintained accuracy is secured through holding chuck and clamping device which provide positive file alignment, and balanced moving parts which operate without vibration. *Write for descriptive literature.*

ILLINOIS TOOL WORKS

Manufacturers of Metal Cutting Tools and Shakeproof Products

2501 N. Keeler Avenue — Chicago, Illinois



Designed To STAND THE GAFF!

CHAMFERED CORNERS -- FOR LOCATING BASE OF LETTER

Hand cut from special formula steel developed during 90 years of die making. Faces angled for extreme strength. Letters deep cut for lasting clarity. Types for all trades. Write for details, stating your need.

THE HOGGSON & PETTIS MFG. CO.
NEW HAVEN 7, CONN.

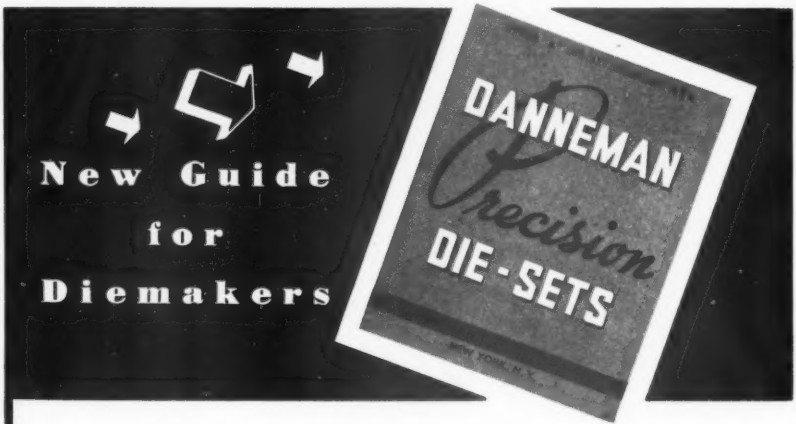
Industrial Work Illuminators Relieve Eyestrain

FATIGUE and eyestrain can now be relieved by the use of special industrial work illuminators, magnifying and inspection units, said to expedite and facilitate difficult operations on small parts and inaccessible locations.

The work illuminators comprise many different types of highly specialized electric lamps, designed to meet the peculiar requirements of localized industrial illumination. Different models are offered for either permanent or portable application and for placing the correct amount and quality of concentrated light at actual point of operation. Thus, it is claimed, the vital parts of a machine may be illuminated from any desired angle and directed upon the exact action-area of such devices as grinders, lathes and cutters to enable the worker to safely do his job more accurately and speedily.

It is reported that machine operators who work to close tolerances find Acrolite illuminators invaluable not only because they permit better vision, but also because they are equipped with soft, glareless Verd-A-Ray lamps which conserve Vitamin A and reduce worker fatigue.

Complete information and illustrated literature may be obtained from the Acro Tool & Die Works, 5323 N. Kedzie St., Chicago, Ill.



● We have just issued our latest catalog on precision bored die-sets. Each style illustrated with blue print drawings giving details of die space, thickness and dimensions.

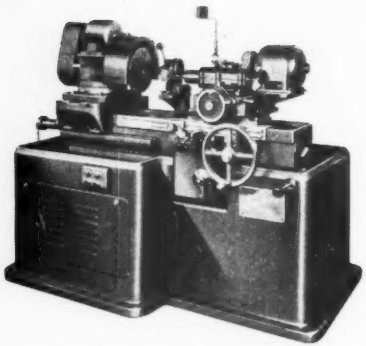
This catalog is an essential guide for every tool shop and die department. Send for your copy today.

In Stock — Assembled on Order

DANNEMAN DIE-SET COMPANY

201 Lafayette St. Phone CAnal 6-1759 New York 12, N. Y.

Simultaneous Head and Hydraulic Table Operation Featured in Grinder



Sav-Way Industries of Detroit, Mich., has recently announced the addition to their line of an internal grinder which incorporates a new and exclusive Sav-Way feature.

Designed to meet varied grinding conditions, this new grinder provides both hand and hydraulic table operation, each of these wholly independent of the other. It is possible, however, to use both hand and hydraulic feed combined on the same job and in the same setting.

The hand operation is said to be advantageous because it gives the worker complete control for setting up. It is frequently preferable for short holes, blind holes and facing; while with the hydraulic system, high table speeds are obtainable for long holes. These table speeds range up to 55 fpm.

Improvements in the design, method of manufacture and technique of operation of British temperature measuring equipment is discussed in an article by Eric N. Simons on page 117.

Minimum table stroke is ⅜", maximum 24". The base of the Model M-H-2 internal grinder measures 70¼" x48½"; the floor space required is 105"x48½"; and its approximate weight is 5300 lbs.

Other special features of this unique internal grinder that help speed up production are contained in a folder available from:

Sav-Way Industries, Box 117, Harper Station, Detroit 13, Mich. 16-C

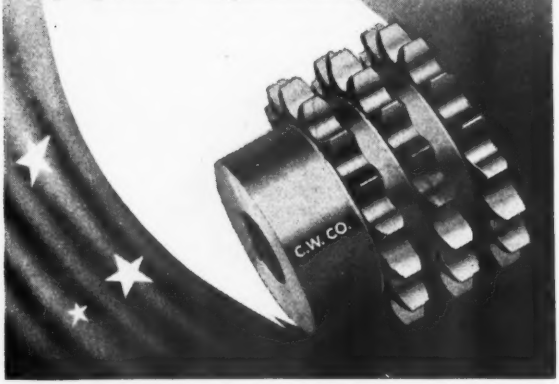
For *RUSH* War Jobs Order

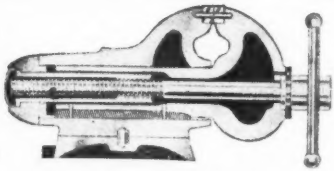
Cullman Sprockets

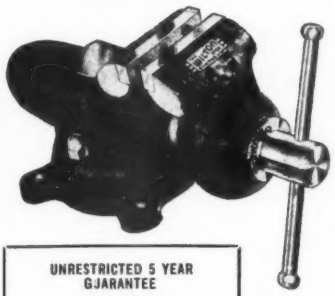
More than 50,000 Cullman Sprockets are available from stock for immediate delivery.

Because of specialized equipment and experience, Cullman Sprockets can be made to your specifications in a relatively short time, and at minimum cost.

Write, telephone, or wire Cullman on any sprocket requirements.







SOMETHING REALLY NEW IN BENCH VISES

- INDESTRUCTIBLE
- INTERCHANGEABLE JAWS
- NO SIDE TWIST OR WOBBLING
- PRECISION GUIDED STEEL KEY (at base)

SIZES AND PRICES
(Subject to Discount)

Width of Jaws	Maximum Opening	Approx. Weight	Price Without Swivel	Price With Swivel
2"	2"	10 lbs.	———	$10.40
3"	4½"	19 lbs.	$10.50	12 80
4"	5¼"	37 lbs.	16.40	18 60
4" Heavy Duty	7"	48 lbs.	17.90	21.00
4½"	5¼"	40 lbs.	19.10	21.30
4½" Heavy Duty	8½"	55 lbs.	23.00	27.50
5"	8½"	58 lbs.	28.00	33.60
6"	9½"	106 lbs.	48 50	62.00

Extra Jaws Available	2"	3"	4"	4½"	5"	6"
Smooth, Precision Ground Steel, Hard or Soft...	$1.65	1.90	2.85	3.30	4.40	5.50 pr.
Brass or Copper, Smooth.....	2.00	2.20	3.10	3.65	5.50	6.45 pr.

Sizes 3", 4" H. D., 4½" H. D. and 6" are built to conform to Federal Specifications GGG-V-436 as required by Army, Navy, etc.

UNRESTRICTED 5 YEAR GUARANTEE

Send for Precision Production Tool Catalog No. 42

Good Delivery on Most Sizes

ACME TOOL COMPANY - 156 CHURCH STREET NEW YORK 13, N. Y.

Penrod Centrifugal Coolant Pumps

Penrod Pumps Easily Applied, Give Better Service

Penrod Pumps are conventional in style but incorporate many new features such as replaceable seal assemblies, totaly enclosed motors, grease sealed ball bearings and streamlined design.

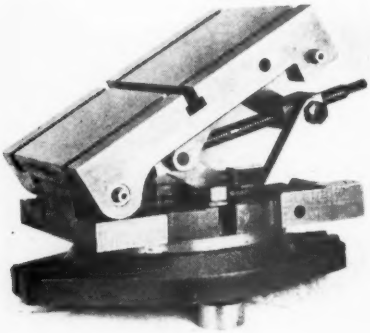
Model P-10h pump (left) uses the motor for mounting and can be located in any position as long as the liquid will flow into the pump by gravity. This pump is easily installed on old or new machines. Model P-30 V Pump (right) is for submerging into the coolant reservoir, and is especially suitable for use with coolants containing abrasives or small chips.

Tanks built especially for Model P-10-⅛ and Model P-30 V-⅛ Pumps can be supplied promptly.

Model P-10H and Model P-30 V pumps are ready for immediate delivery. Phone or wire us for details.

FLOYD PENROD & SONS
TOOL & ENGINEERING COMPANY
1208-1216 W. 2nd Street Muncie, Indiana

Elevating Screw Secures Accurate Plate Position



An outstanding feature of the Adjustable Angle Plate manufactured by Producto Machine Company of Bridgeport, Conn., is the new idea of an elevating screw to secure accurate position of the plate for use in mounting work up to a 45-degree angle.

This is especially effective for horizontal boring mills, milling machines, drill presses, etc., because this type of construction permits a quick and positive method of locating the work to correct angle.

These angle plates come in three sizes; the two smaller sizes are machined to be used with or without swivel as they are equipped with a swivel base—the large size is not. Sizes 1 and 2 are made with two T-slots lengthwise and one T-slot sidewise. Size 3 has two lengthwise and three crosswise slots for ⅜", ½" and ⅝" bolts.

For measuring extreme accuracy in locating the desired angle, each plate is fitted with hardened and ground sine bar buttons.

The net weight of the three sizes of Producto Adjustable Angle Plates is 78 lbs., 115 lbs., and 425 lbs. respectively.

Other Producto products include a precision vise for tool room use, swivel and angle vises, universal shaft vise and machine vises.

Write the Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn., for illustrated circular. 91-C

Here's What You Need For . . .
MANY TEDIOUS JOBS
Time—our most valuable asset today—can be saved by the use of a Duro Hand Grinder. Cutting, grinding, polishing, etc. on small parts requiring hand work, is easily and rapidly executed.
Duro Hand Grinders are powerful and durable. The G. E. Universal Motor develops 42 watts output running at 24,000 R.P.M. Kept cool in operation by propeller type fan. Spindle operates on sealed N. D. ball bearings which take up all radial and thrust load. Fitted with collet chuck up to ¼" capacity. Streamlined to fit operator's hand. Ideal for tool post grinding.
Ask for details and list of accessories
Duro Metal Products Company
2653 N. Kildare Ave. CHICAGO, ILL.
DURO HAND GRINDER
DURO FOR DURABILITY★
FOR DIE WORK
FOR TOOL POST GRINDING
FOR POLISHING
FOR ROUTING
FOR DRILLING
FOR

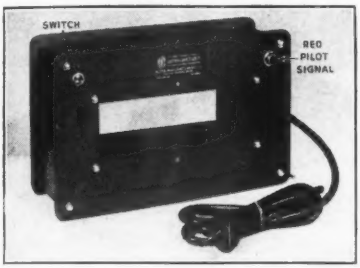
THE COST OF CUTTING FLUIDS IS MEASURED IN PENNIES
. . . TOOLS AND PRODUCTION IN DOLLARS

IT pays to use the best. Stuart's Thred-Kut, Solvol, "Super-Kool" and Codol are the best money can buy. A Stuart Oil Engineer will be glad to help you choose the best cutting fluid for the job. Call him in.

Stuart's Thred Kut SOLVOL "SUPER-KOOL" CODOL

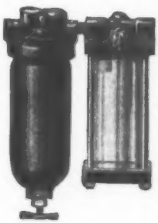
For All Cutting Fluid Problems
D. A. STUART OIL CO.
Chicago, U.S.A. • LIMITED • Est. 1865
Warehouses in All Principal Metal Working Centers

AMC DEMAGNETIZER
A Tool Room Necessity



Every tool room needs this simple, portable, sturdy demagnetizer. Small parts passed through the powerful AMC field are instantly demagnetized. Large, flat surfaces can be demagnetized by sliding the device over the surface.
Price is only $32.50, complete as shown.
Write for full information.
ALOFS MFG. CO.
1619 Madison Ave., S. E., Grand Rapids, Mich.

• M - B •
AIR-LINE FILTER and AUTOMATIC LUBRICATOR
Removes 96% to 97% of All Water, Dirt and Scale from Airline



Air passes through a series of brass discs with .002 spacings, providing the finest degree of filtration obtainable by any known method. Then, as the air passes through head of Lubricator, oil is delivered into the purified air line in any desired volume.
A combination of this kind is only as efficient as the filter unit of the assembly.
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EVANS *High Speed Steel* REAMERS
LOOK AT THESE FEATURES
• No honing.
• Will not chatter.
• Chrome-like finish.
• Perfect alignment.
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• Left and right spirals.
• 35 to 80 thousandths expansion.
• Cannot fail in slots or oil grooves.
• Extension pilots for line-up work.
EVANS REAMER and MACHINE CO.
Successors to EVANS FLEXIBLE REAMER CORP.
4543 Ravenswood Ave. Chicago, Ill.
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WE HAVE some tapping operations at this plant which are correctly termed as "tough". To meet production requirements we had to make our own taps for the DIFFICULT tapping jobs.

That's what put us in the tap business.

We offer our service to the industry on the basis of experience.

HIGH SPEED TOOL BITS—*another specialty*

AGERSTRAND CORPORATION

Muskegon, Michigan

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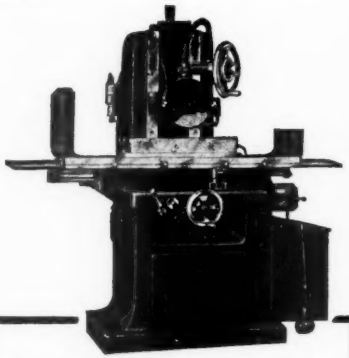
A Complete Manufacturing Plant

ANNOUNCING "AIR-CLAMP"

For Greater Drill-Press Output

Wherever a drill comes down, something must hold the work. Wherever a drilling-jig is required, *Air-Clamp* will simplify it. Wherever *speed* is desired. *Air-Clamp* will produce it. *Air-Clamp* holds with relentless pressure; is undisturbed by size variations (such as in castings), it scoffs at vibration (how many drills have been broken due to faulty hold-downs?), chatter, snagging. *Air-Clamp* holds work of any size or shape in any position, at any angle. It can pay for itself on a single fixture; it can save its cost on a few days' drill-press output. Reduces operator-fatigue. Saves hours and dollars in drafting room, jig department, tool room and production line. *Air-Clamp* fits any drill-press having a cylindrical column. Special fixtures for Tee-slotted tables, light milling work, etc. Hand and/or foot control. Shipped on approval to responsible concerns.

MEAD SPECIALTIES COMPANY
15 S. Market St., Dept. 93-HA, Chicago, U.S.A.



Grand Rapids Surface Grinders are the result of over thirty years actual experience in the building of precision grinding equipment . . . A patented vertical head adjustment is featured. When using the circular Vernier reading for extreme accuracy, the graduated circular plate can be set at zero in relation to the pointer extending inward from the rim of the large hand wheel. The pointer will travel in the same direction as the small inner hand wheel, but at ⅛th the speed . . . Attractive and amply illustrated Bulletin GL-100 is available.

GALLMEYER & LIVINGSTON CO.
304 Straight Ave., SW Grand Rapids, Mich.

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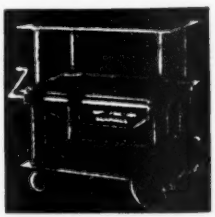
PORTELVATOR (*Portable Elevating Table*)

From little fellows to giants of 20-ton capacity PORTELVATOR models earn their way in any plant. Carry tools, parts, finished or in-process work. Use as bench for overhang. Use as support. Adaptable in 1,001 ways.



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HAMILTON OHIO

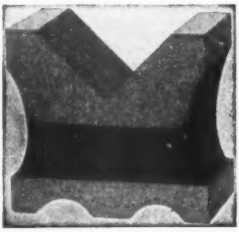
SAVE TIME ★ AVOID REJECTS

with The Inspectograph

Large four inch lens magnifies inspected object to double its size and provides wide field of vision for both eyes without eyestrain.
Two fluorescent tubes project strong, shadowless light directly on the work being inspected.
This combination of engineered lighting and magnification quickly exposes defects such as faulty or torn threads, cracks, burrs, scratches, etc., not apparent to the naked eye.

S. Lowe & Sons, 100 Sanford St., Fairfield, Conn.

"TRU-V" BLOCKS



Why Not Save Time — by having enough V-Blocks available at all times in your shop to avoid the delays involved in make-shift set-ups and tie-ups?

"TRU-V" Cast-Iron Blocks are available in nine sizes—from 3½ to 10" in three styles. Each block is carefully machined on all sides, with close limits held within .001" where required. A machined ledge on both sides provides for clamping on machine bed.

Let us send descriptive bulletin.
Or contact your mill supply dealer.

Oliver Motorcraft Corp.
2536 S. Wabash Ave., Chicago, Ill.

That's DUSTKOP Dust Collector.

Only a few minutes are required to connect up DUSTKOP. The intake makes a slip fit with flexible metal hose so that there is NO DUCT WORK *required.* Equipped with G.E. motor (or equal) and multiple-blade fan, DUSTKOP is ideal for collecting dust from tool, surface, cutter and internal grinders. Dust laden air is cleaned by cyclone separator with spun glass filter as added safeguard. Prompt deliveries on high priorities.

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Micro Supreme

IMPROVED LAY-OUT DYE

for SHARPLY DEFINED SCRIBED LINES

for TOOL, DIE, PATTERN, OR TEMPLATE LAYOUT ON METAL

LOW IN PRICE
One Gallon $4.25

MICHIGAN CHROME & CHEMICAL COMPANY
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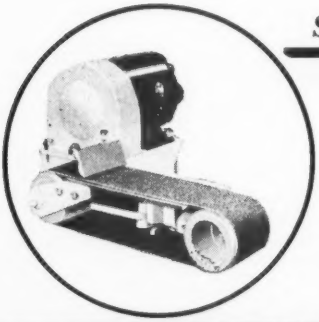

SAVES TIME • CUTS COSTS

STANDARD D-4 ABRASIVE BAND GRINDER

This new, streamlined bench type grinder assures fast, quality finishing on metals, plastics, wood, fibre . . . at low cost. Built to machine tool specifications, Standard D-4 is equipped with improved band tension control and specially designed protective motor hood. 4x36¼" band. The ideal portable unit!

Other styles and sizes in New Booklet on Finishing — Write Today

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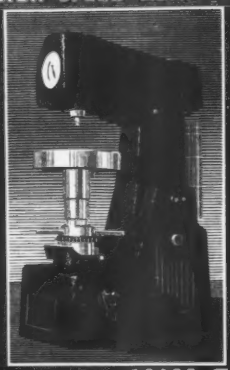
THEY HAVE EVERYTHING—
PRECISION · SPEED · ADAPTABILITY



WILSON

CONCORD AVE. NEW YORK MECHANICAL INSTRUMENT CO. INC.

A new department to manufacture metal bonded diamond wheels has been announced by L. H. Metzger, president, Industrial Abrasives, Inc., 3722 W. 38 St., Chicago, Ill.

This firm has perfected its new diamond wheel by an exclusively new and radically improved method of impregnating wheels using a molten metal process. The special alloy used in the matrix is sufficiently hard to anchor every diamond particle. **330-C.**

SMALL DRILL BUSHINGS made to order or work of similar nature. Holes drilled from .004" to .040".

Send details for estimate.

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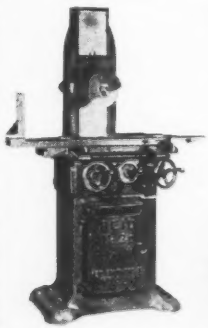

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Equipped with Motorized Spindle

A Proven Product for Over a Quarter Century with Thousands in Use Daily

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SMALL TOOLS, DIES, JIGS and FIXTURES

Designed and Manufactured

KENT AIRCRAFT AND GAUGE CO.

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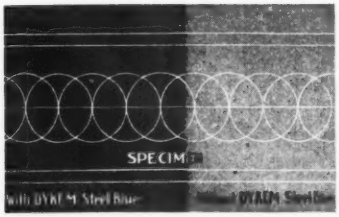

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Simply brush on; ready for the layout in a few minutes. The dark blue background makes the layout lines show up in a sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

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7 ADVANTAGES of the TEMCO Electric Furnace

1 Rugged one-piece body; snug fitting door.

2 Quality Nichrome heating element embedded in reinforced muffle—minimizes oxidation.

3 Heavy-duty switch, monel metal contacts; 3-range heat selection.

4 Rapid heating to max. temp. in but 30 min. Operates continuously to 1500° F.; intermittently to 1850° F.

5 Entire heating element used over full heating range and covers 4 sides of chamber—eliminates cold spots.

6 Accurate, dependable pyrometer calibrated in both Centigrade and Fahrenheit scales assures uniform results.

7 Low in cost; economical in operation.

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Ideal for heat-treating small metal parts and for testing and development. Heat chamber 4" wide, 3¾" high, 3¾" deep. Outside dimensions 9" wide, 13½" high, 10" deep. Available in 115 and 230 volts. Send for descriptive bulletin. **$42.50** (115 Volts)

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drastically reduces setup time. Interchangeable mask plates insure toolroom accuracy. Speeds and Feeds are limited only by power of the machine and the capacity of the holding means.

Circular illustrating numerous applications is available on request.

THE HARTFORD SPECIAL MACHINERY CO.

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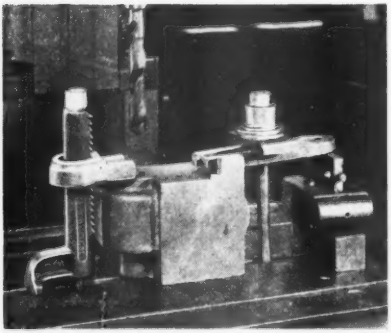

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SPEAKS FOR ITSELF

Howell "high speed" adjustable work clamps save time, trouble and worry. Why risk tool breakage, job spoilage or injury by using make-shift methods? Send for descriptive literature describing these unique clamps.

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(Reg. Trade Mark)
HEAVY BEVEL

LETTERS and FIGURES

"SAFETY" steel construction . . . Deeper impression . . . Will not spall, will not mushroom . . . For all types of marking . . . Any size character from 1/10" up . . . Immediate delivery.

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SAFETY STEEL STAMPS
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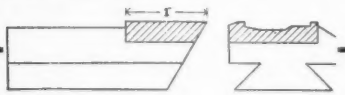

We would like to quote on Carbide Tipped Dovetail Form Tools in lots of 20 or more. We are SPECIALIZING on this type of tool and can give you VERY GOOD DELIVERY.

We use a CARBIDE TIP 1" LONG which will give you almost 1" of tool grind.

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Grinders instruction card free.

Cooler dressing
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Because: Wing key heat dissipation and absolute diamond lock nib.

● Three grades of diamonds. Common quality $12 per karat. Medium quality $24 per karat. Select quality $48 per karat. (Contour template diamonds supplied only in Medium and Select quality.)
All diamond sizes ¼ to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. We recommend a minimum size of one karat for each 6" diameter of grinding wheel. (24 hour resetting service, $1.00 post paid.)

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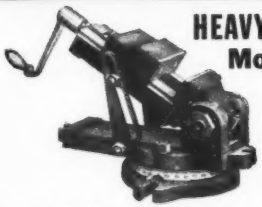
PALMGREN
ANGLE VISES



HEAVY-DUTY
Model

For Quick — Accurate Set-ups

PALMGREN Heavy Duty Angle Vises are built sturdy and rugged for tough, heavy jobs. They are accurately graduated in degrees, can be quickly adjusted to any angle, stay locked under severe service and save valuable hours otherwise wasted in tedious make-ready, wedging or making temporary jigs and fixtures.

Jaws are hardened and ground. Special outstanding features are the size and opening of jaws—4" Jaws open full 4", the 6" Jaws open full 6", etc., with corresponding depth of Jaws. Vise can be used as ordinary vise when lowered to horizontal position. Swivel bases furnished if desired. Sizes 4", 6" and 8" Jaws and openings. Prompt deliveries.

Write for Bulletin 36 "90 Angle Operations" and complete line of PALMGREN Vises

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HAMILTON
SWISS TYPE
GEAR HOBBERS

for accuracy and speed in hobbing

pinions, wheels, gear sectors and similar component parts of Aviation Instruments, Time Fuzes, Meters, Clocks, Watches, and other precise mechanisms.

No. 00 SPUR GEAR HOBBER,

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If your production requires the cutting of highly accurate fine pitch gears and pinions, write TRIPLEX for complete detailed specifications.

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PINT 60
QUART 90
GALLON . . 2.50

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Illustrated No. 4 Motor Driven Machine mounted on cabinet column. Write for complete details.

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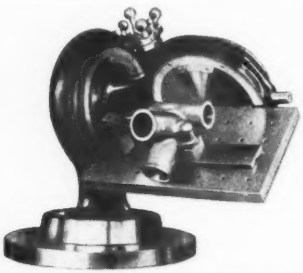

Computes Angles QUICKLY

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THE ANGLE COMPUTER COMPANY
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NORMALLY IN STOCK

N.E. Steels and Standard S.A.E. Steels, both Carbon and Alloy, Hot Rolled and Cold Drawn ● Chisel Steels ● Cumberland Ground Shafts ● Drill Rod ● High Speed Tool Bits ● Shim Steels ● Tool Steels ● Boiler Tubing.

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BISSETT Steel

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A REAL HELPING HAND

It's a help that die makers, tool makers, machinery builders and general machinists have long sought—a more accurate and surprisingly faster way of transferring blind screw holes.

The Heimann Transfer Screw Set is a self-contained, complete tool. No wrenches or pliers are necessary. Made in ¼" to 1" diameters.

Send for price list.

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A.C.E. *Special* CUTTING TOOLS HELP YOU MAKE *Production Quotas*

Send your special cutting tool inquiries to A. C. E.—headquarters for cutting tools made to customer's prints.

We have modern machinery and equipment, modern methods, trained operators and the "Know How" to turn out special cutting tools that meet your requirements in accuracy, precision and workmanship. Note: We make no tools for stock.

Send us your immediate needs for prompt inquiries. Bulletin on request.

Certain desirable territories still available for active representatives.

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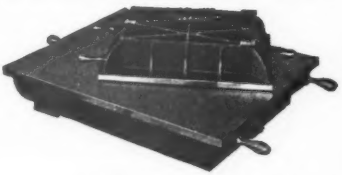
AMERICAN CUTTER
AND ENGINEERING CORP., WARREN, MICH.
SPECIALIZING IN HIGH SPEED CUTTING TOOLS TO YOUR PRINTS

MILWAUKEE SURFACE PLATES



A full line of surface plates, angles and box parallels. Standard plate sizes from 8" x 12" to 48" x 96", larger sizes with or without legs. Plates are finish-planed and scraped to insure a very accurate surface.

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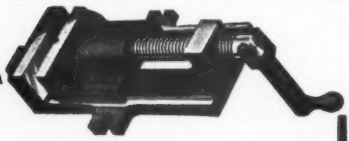

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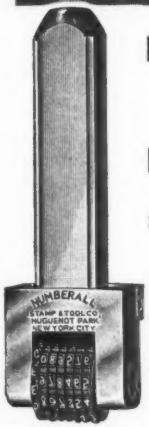

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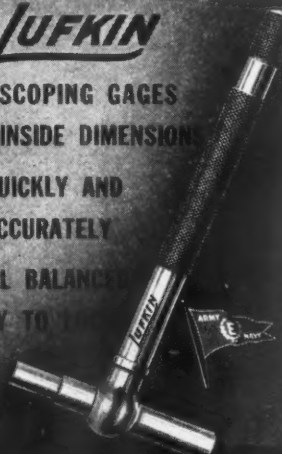

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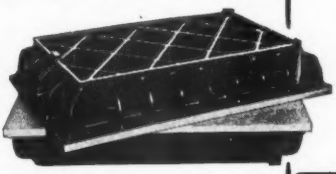

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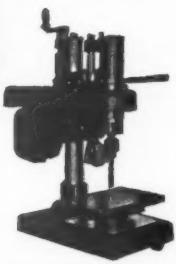

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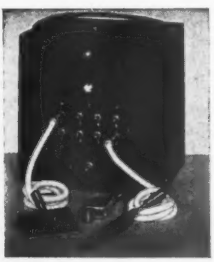

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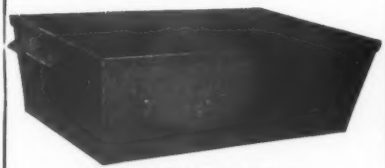

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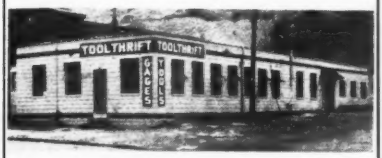

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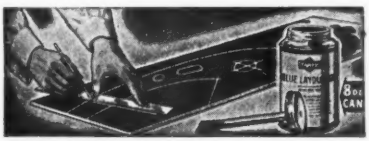

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Sizes from 1/10 to 2 h. p. Pumping capacity up to 200 g.p.m. Many patented and exclusive features.

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MOST CAPACITY
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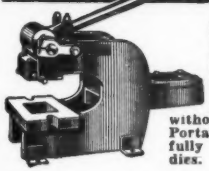

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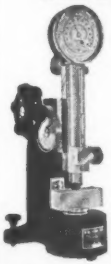

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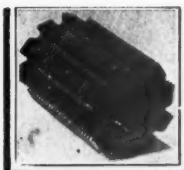

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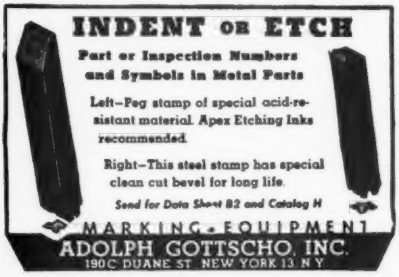
Part or Inspection Numbers and Symbols in Metal Parts



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15 STANDARD SIZES

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Precision made (and we do mean "precision") from ⅝" to 4" Hub Diam. to Army, Navy, Air Corps spec. AN-40236 ready to install. ⅝" to 1" sizes in stock. Increase Lathe Production with Dix-Wilder Automatic Collet Closers and Multiple Carriage Stops. Immed. Delivery. Write, wire for detail, data, etc.

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(Continued from Page 235)

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"Let us be your tool room."
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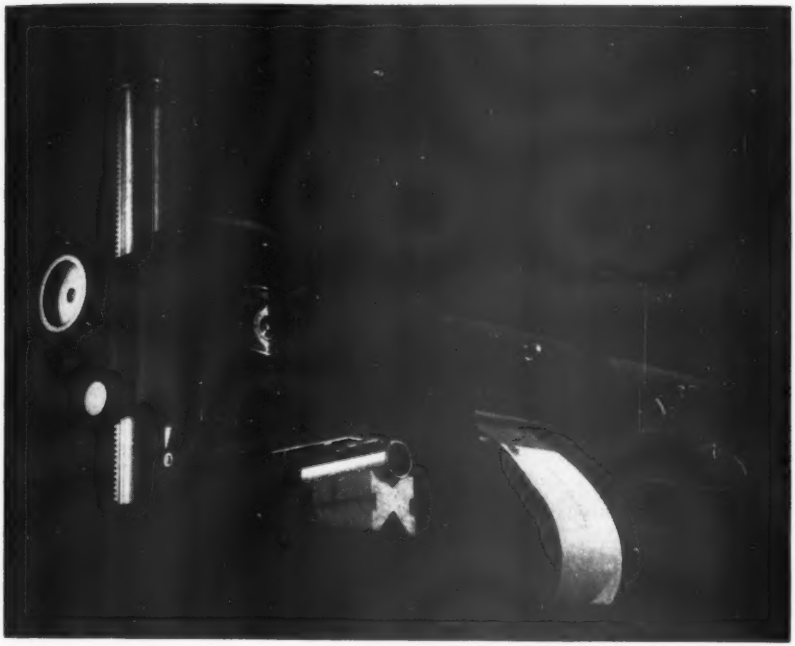

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for War . . and the Peace to come

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See us in **ROOM 843** at the National Metal Show

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Workers' Living Costs going up . . . and Income and Victory Tax now deducted at source for thousands of workers . . .

Check! You're perfectly right . . . but all these burdens are more than balanced by *much higher* FAMILY INCOMES *for most of your workers!*

Millions of new workers have entered the picture. Millions of women who never worked before. Millions of others who never began to earn what they are getting today!

A 10% Pay-Roll Allotment for War Bonds from the wages of the family bread-winner is one thing—*a 10% Pay-Roll Allotment from each of several workers in the same family is quite another matter!* Why, in many such cases, it could well be jacked up to 30%—50% or even more of the family's *new* money!

That's why the Treasury Department now urges you to revise your War Bond *thinking*—and your War Bond *selling*—on the basis of *family* incomes. The current War Bond campaign is built around the family unit—and labor-management sales programs should be revised accordingly. For details get in touch with your local War Savings Staff which will supply you with all necessary material for the proper presentation of the new plan.

Last year's bonds got us started—*this year's bonds are to win!* So let's all raise our sights, and get going. If we all pull together, we'll put it over with a bang!

This space is a contribution to America's all-out war effort by

Stall of
THE TOOL & DIE JOURNAL

you've done your bit
. . . now do your best!

★ ★ ★ ★ ★ ★ ★ ★ ★

Get the Facts!
SEND FOR THIS NEW FOLDER
DESCRIBING AND ILLUSTRATING IN DETAIL
HOVIS
UNIVERSAL MASTER WASHER DIES
The New Economy Method of Making Washers
The HOVIS ECONOMICAL METHOD OF MAKING WASHERS
COMPANY
VAN DYKE, MICHIGAN

LEARN all about this sensational new way of making washers that is now so widely adopted among the big industrial firms of America. No longer is it necessary to go to the expense of making a complete compound die for each new washer. Use the Hovis advanced method, consisting of a die complete in itself, ready to use, made on an all-steel precision standard die set which comes complete with gauges and stops. From these dies you can remove five small interchangeable parts without dismantling the die. Once your initial investment is made in Master Washer Dies of the sizes to fit your needs, FIVE SMALL INTERCHANGEABLE PARTS ARE ALL THAT IS NECESSARY TO BUY TO MAKE ANY SIZE WASHER. This simple method means a big saving in materials and labor.

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SCREWLOCK CO.
8100 E. Nine Mile Road
Van Dyke Michigan
Builders of Detroit Precise Quality since 1875

It eliminates all process engineering, tool designing, tool making and tool try-out.

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Immediate Shipment
STEEL BOXES
FOR YOUR PRODUCTION NEEDS

STYLE 300 STACKING BOX

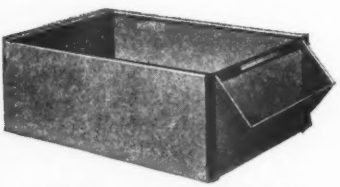
Just right for your small parts. Light in weight, easy to handle. Equipped with drop handle each end. Runners save wear on bottom of box and act as positive stacking lock.

No. 301	6" x 9 " x 3½"	20 ga.	$ .55 Ea.
No. 302	8" x 12 " x 4 "	20 ga.	$ .60 Ea.
No. 303	9" x 13½" x 4½"	19 ga.	$ .75 Ea.

STYLE 600 STACKING BOX

An ideal all-purpose shop box. Sturdy all-welded construction. Heavy skids act as positive stacking lock and re-inforce box at point of maximum wear.

No. 601	10" x 16" x 6"	18 ga.	$ .95 Ea.
No. 602	12" x 18" x 8"	16 ga.	$1.25 Ea.



STYLE 500 STACKING BOX

Open front makes contents easily accessible when boxes are stacked. Will stack with Style 600 boxes.

No. 501	10" x 16" x 6"	18 ga.	$1.15 Ea.
No. 502	12" x 18" x 8"	16 ga.	$1.50 Ea.

STYLE 100 TAPER PAN

One piece, all-welded construction. Hook handle at each end. Will nest perfectly when empty.

No. 101	10" x 18" x 6"	18 ga.	$ .75 Ea.
No. 102	12" x 20" x 6"	16 ga.	$ .90 Ea.

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3" BAR

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NEW ACCURACY IN MILLING

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Many machines in operation show 75% greater average daily productivity and improved dependability for precision.

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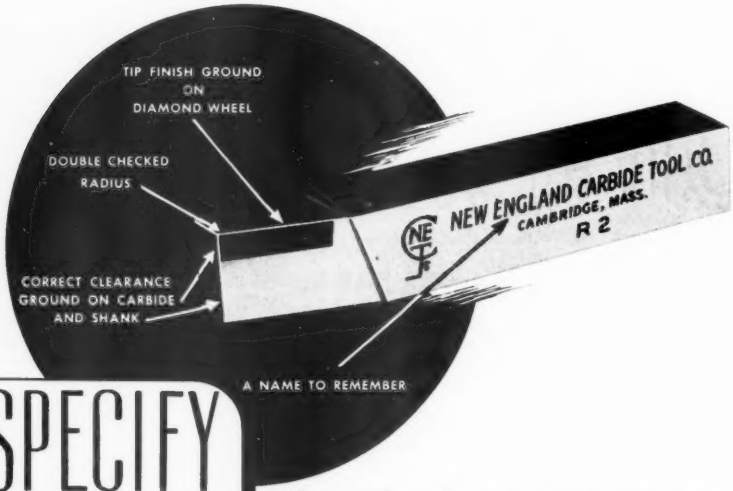
DEVLIEG MACHINE TOOLS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CORRECT CLEARANCE GROUND ON CARBIDE AND SHANK
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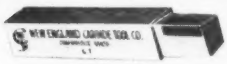
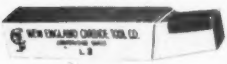
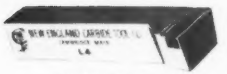


Tool Style No. 1



Tool Style No. 2

Tool Style No. 3



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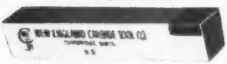
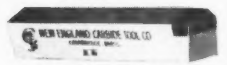


Tool Style No. X5



Tool Style No. X6

Styles 1 to 4 furnished right- or left-hand

New England *Standard* Carbide Tools are precision built—every tool is ready for the job, because correct radii and clearances are finish ground to correct tolerances. *Standard* tools are supplied with "U" grade tips for cutting aluminum, cast iron, brass, bronze and non-metallics, and in "S" grade for steel.

We will be pleased to arrange delivery schedules to produce your standard or special tools with any make or grade of carbide specified by you.

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Please send me your new Standard tool folder and a Standard tool wall chart for our tool room. TDJ

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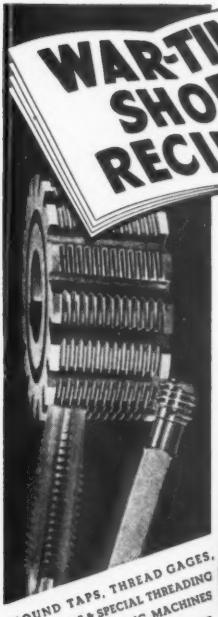

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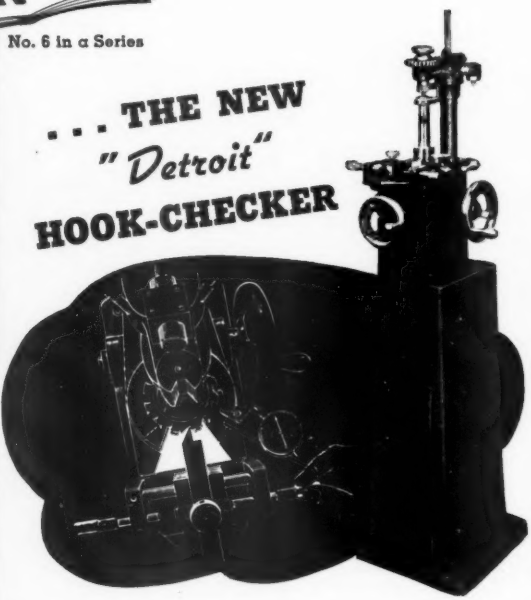
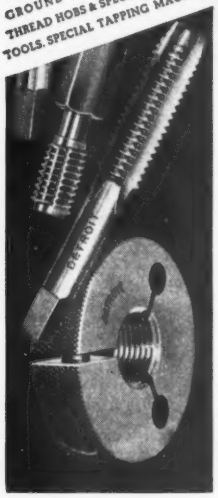
No. 6 in a Series

TO CHECK YOUR THREAD HOBS FASTER . . . . .

. . . THE NEW "Detroit" HOOK-CHECKER



GROUND TAPS, THREAD GAGES, THREAD HOBS & SPECIAL THREADING TOOLS, SPECIAL TAPPING MACHINES



Designed by Detroit Tap and Tool Company to speed production checking of its own thread milling cutters, this new universal hook-checker is being made available to industry generally.

It does not require special setting up for each 'hob'. All you do is slip the cutter between centers, bring a knife edge against the ground side of the sharpened face, by turning a micrometer until you can't see light between the two. Read the 'mike'. A convenient table then tells you whether the cutter is right or how much it is off. A dial tells whether flutes are correctly spaced.

Ask for bulletin No. HC-43 covering this new checker. It also gives useful hints as to sharpening of thread milling cutters.

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with your present labor force . . . by using

DELTA *Power-Feed* DRILL PRESSES

It doesn't cost a fortune or entail a long delay for retooling. Standard low-cost Deltas, used in hundreds of war plants, give quick relief from production "jams." Speedy operation saves time, power feed works automatically while operator loads another jig or works on another spindle.

These are thoroughly engineered, substantially built, good-looking machines, made in a modern machine-tool plant. Advanced design combines best features of machines of this type. Safe, dependable, performance quickly pays for the machines and confirms your good judgment.

Ask your Delta distributor about priorities and deliveries. *Mail the coupon for new Delta catalog.*

DELTA FEATURES

1. Worm-driven power feed operates directly off motor — giving 8 *rates of feed for each spindle speed.*

2. One swift hand motion brings drill down to work—flip of power lever starts power feed.

3. Automatic stop holds depth of holes to close tolerances; spindle returns automatically.

4. *Instant* switching from heavy power-feed operations to sensitive hand drilling.

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M-3CC

THE DELTA MANUFACTURING CO., 612K E. Vienna Ave., Milwaukee 1, Wis.
Please send me your new catalog giving full details on Delta Power-Feed Drill Presses and your full line of low-cost machine tools.

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Company_____

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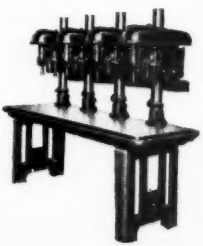
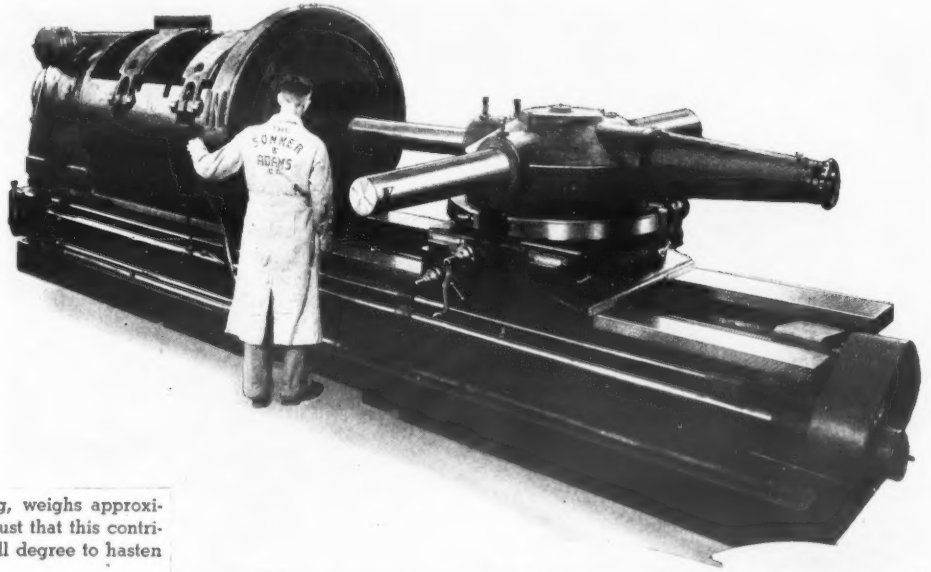
With one-piece tables: Floor and bench types, single spindle; floor type, 2- and 4-spindle. With sectional tables: Floor type, 3-, 4-, 5-, 6-, and 8-spindle. Slo-Speed or High-Speed No. 2 Morse Taper or ½" Jacobs Chuck spindle.



THE ARMY-NAVY "E" —*awarded for excellence in the production of machine tools vitally needed in the war effort.*



Typical of special equipment designed and built by Sommer & Adams is this large boring and thread milling machine, which handles those operations on the breech rings of 5" guns. It is 22 feet long, weighs approximately 60,000 pounds. We trust that this contribution may help in some small degree to hasten the coming of final peace.

The Sommer & Adams Company places at your command a 25-year acquaintance with the intricacies of special machine design and construction.

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Custom-Built EQUIPMENT FOR MANY PURPOSES

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How Would YOU Do It?

(Cutting an I-Beam that has been rolled into a large diameter ring into segments. A typical example of the versatility of the No. 8 MARVEL Band Saw.) At the Kling Bros. Engineering Works, Chicago, manufacturers of rolled structural shapes, three MARVEL No. 8 Metal-cutting Band Saws are proving "A-1" and "100%". In the MARVEL System there are saws exactly suited to every shop's need—and for structural shapes, the universal MARVEL No. 8 is ideally suited, because it handles all work up to 18" x 18" cross-section and does cutting-off, mitering and notching. The blade feeds into the work at any angle from 45° right to 45° left. It is the most versatile metal-cutting saw built.

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